Final

Site Investigation Report
Range 23A, Multipurpose Range
Parcel 109(7)/152Q-X

Fort McClellan
Calhoun County, Alabama

Prepared for:

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Task Order CK05
Contract No. DACA21-96-D-0018
Shaw Project No. 774645

January 2004

Revision 0

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Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK05, Shaw Environmental, Inc. completed a site investigation (SI) at Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X, at Fort McClellan in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site as a result of mission-related Army activities. The SI at Range 23A consisted of the collection and analysis of 11 surface soil samples, 11 subsurface soil samples, 4 groundwater samples, 6 surface water samples, and 6 sediment samples. In addition, 4 permanent monitoring wells were installed at the site to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at the site indicates that metals, volatile organic compounds (VOC), semivolatile organic compounds, and one explosive compound were detected in the environmental media sampled. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for Fort McClellan. Site metals data were further evaluated using statistical and geochemical methods to determine if the metals detected in site media were naturally occurring. A preliminary ecological risk assessment was also performed to characterize the potential threat to ecological receptors.

Although the site is located on Pelham Range and is projected for continued military training, the analytical data were evaluated against residential human health SSSLs to determine if the site is suitable for unrestricted future use. Various metals (aluminum, arsenic, barium manganese, and thallium) were detected in site media at concentrations exceeding SSSLs and background and, thus, were selected as chemicals of potential concern. However, the statistical and geochemical evaluation determined that the metals detected in site media were all naturally occurring. Acetone was also identified as a chemical of potential concern in groundwater. Although acetone was detected at an estimated concentration exceeding its SSSL in one groundwater sample, the compound is a common laboratory contaminant and is not believed to be site-related.

The preliminary ecological risk assessment did not identify any constituents of potential ecological concern in site media. Therefore, potential risks to ecological receptors were judged to be insignificant.

Based on the results of the SI, past operations at Range 23A do not appear to have adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, Shaw Environmental, Inc. recommends "No Further Action" and unrestricted land reuse with regard to CERCLA-related hazardous substances at Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X.

1.0 Introduction

The U.S. Army has selected Fort McClellan (FTMC) located in Calhoun County, Alabama, for closure by the Base Realignment and Closure (BRAC) Commission under Public Laws 100-526 and 101-510. The 1990 Base Closure Act, Public Law 101-510, established the process by which U.S. Department of Defense (DOD) installations would be closed or realigned. The BRAC Environmental Restoration Program requires investigation and cleanup of federal properties prior to transfer to the public domain. The U.S. Army is conducting environmental studies of the impact of suspected contaminants at parcels at FTMC under the management of the U.S. Army Corps of Engineers (USACE), Mobile District. The USACE contracted Shaw Environmental, Inc. (Shaw) (formerly IT Corporation [IT]) to perform the site investigation (SI) at Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X, under Contract Number DACA21-96-D-0018, Task Order CK05.

This report presents specific information and results compiled from the SI, including field sampling and analysis and monitoring well installation activities conducted at Range 23A, Parcel 109(7)/152Q-X.

1.1 Project Description

Range 23A was identified as an area to be investigated prior to property transfer. The site was classified as both a Category 7 and a Category 1 Qualified parcel in the *Final Environmental Baseline Survey, Fort McClellan, Alabama* (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 7 parcels are areas that are not evaluated or that require further evaluation. Category 1 Qualified parcels are areas that have no evidence of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related hazardous substance storage, release, or disposal but that do have other environmental or safety concerns. Range 23A was qualified (X) for potential unexploded ordnance (UXO) because of historical range activities.

A site-specific work plan, comprised of a field sampling plan (SFSP), a safety and health plan, and a UXO safety plan, was finalized in October 2001 (IT, 2001). The work plan was prepared to provide technical guidance for SI field activities at Range 23A, Parcel 109(7)/152Q-X. The site-specific work plan was used as an attachment to the installation-wide work plan (IT, 1998) and the installation-wide sampling and analysis plan (SAP) (IT, 2000a; IT, 2002). The SAP includes the installation-wide safety and health plan and quality assurance plan.

The SI included fieldwork to collect 11 surface soil samples, 11 subsurface soil samples, 4 groundwater samples, 6 surface water samples, and 6 sediment samples. Data from the field investigation were used to determine whether potential site-specific chemicals are present at the site and to provide data useful for supporting any future corrective measures and closure activities.

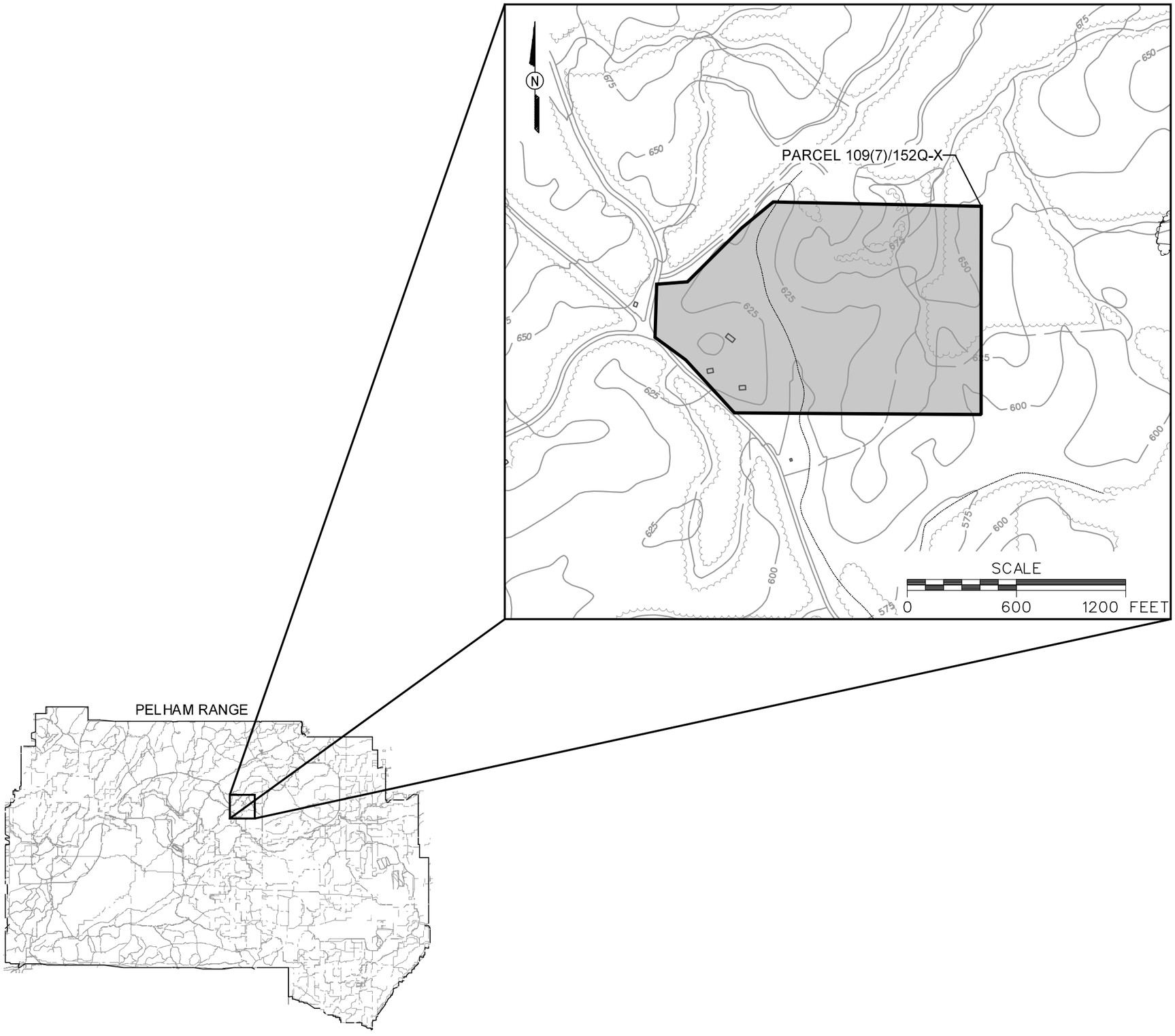
1.2 Purpose and Objectives

The SI program was designed to collect data from site media and provide a level of defensible data and information in sufficient detail to determine whether chemical constituents are present at Range 23A, Parcel 109(7)/152Q-X, at concentrations that present an unacceptable risk to human health or the environment. The conclusions of the SI in Chapter 6.0 are based on the comparison of the analytical results to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. The SSSLs and ESVs were developed by Shaw as part of the human health and ecological risk evaluations associated with SIs being performed under the BRAC Environmental Restoration Program at FTMC. The SSSLs and ESVs are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000b). Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998). Site metals data were further evaluated using statistical and geochemical methods to select site-related metals. A preliminary ecological risk assessment (PERA) was also performed to characterize potential risks to ecological receptors.

Based on the conclusions presented in this SI report, the BRAC Cleanup Team (BCT) will decide either to propose "No Further Action" at the site or to conduct additional work at the site.

1.3 Site Description and History

Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X, occupies approximately 41 acres in the north-central portion of Pelham Range (Figure 1-1). The use of this range for training reportedly began in 1987 and continued into 1999. The range is located north of the two large established impact areas on Pelham Range. The site was historically used by the FTMC Chemical School for field flame expedient (FFE) training and was known as the Flame Operations Range. There are no records of projectiles fired at this range (ESE, 1998). Features at this site included a small metal building used for classroom instruction, a vehicle parking area, a fuel tanker parking area, observation bleachers, a fuel mixing area, and a detonation field (CH2M Hill, 2000).



LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 25 FOOT)
- TREES / TREELINE
- PARCEL BOUNDARY
- SURFACE DRAINAGE / CREEK

FIGURE 1-1
SITE LOCATION MAP
RANGE 23A, MULTIPURPOSE RANGE
PARCEL 109(7)/152Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

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Smoke, demolitions, and FFE training activities involved the mixing of either gasoline and M4 thickener, or MOGAS (gasoline) and fog oil to formulate FFE. Fuel containers used at this range were usually 55-gallon drums, which reportedly leaked. Earthen ditches were used for FFE detonation in the "wall-of-flame" and "nuke-simulator" training areas; however, any spillage was reportedly cleaned-up (ESE, 1998).

The detonation field was divided into the following training areas (Figure 1-2):

- Hasty mine field
- Directional area
- Non-directional area
- Wall-of-flame pit
- Nuke-simulator training
- Electric training
- Non-electric training
- Modernized demolition initiators (MDI) training.

Exercises in the hasty mine field training area consisted of detonating approximately 50 small plastic containers of FFE simultaneously; this training activity occurred approximately 40 times per year (CH2M Hill, 2000). The FFE fuel mixture consisted of approximately 50 gallons of gasoline combined with M4 thickener. M4 thickener was mixed at a ratio of about 3 fluid ounces per gallon of gasoline. Sandbags were placed in the larger gullies at the hasty mine field training area to minimize erosion caused by blasting. After the detonation, the resulting fire was allowed to burn. After the fire burned out and the area cooled, trainees searched the area and collected the remaining plastic fragments, which were disposed of properly (CH2M Hill, 2000).

The directional training area is located east of the hasty mine field training area. During the directional training exercise, one 55-gallon drum containing gasoline and M4 thickener was positioned with sandbags so that the flame was directed out in a controlled manner. FFE directional training occurred approximately 40 times per year. A moderate amount of erosion exists on the hillside in this area (CH2M Hill, 2000).

The nondirectional training area is located on a hillside east of the former wall-of-flame training site (Figure 1-2). Five to ten 55-gallon drums were filled with a mixture of equal parts MOGAS and fog oil. One drum contained M4 thickener. The drums were positioned upright, wired together, and detonated. FFE non-directional training occurred approximately 40 times per year. There is moderate erosion on the hillside in this area (CH2M Hill, 2000).

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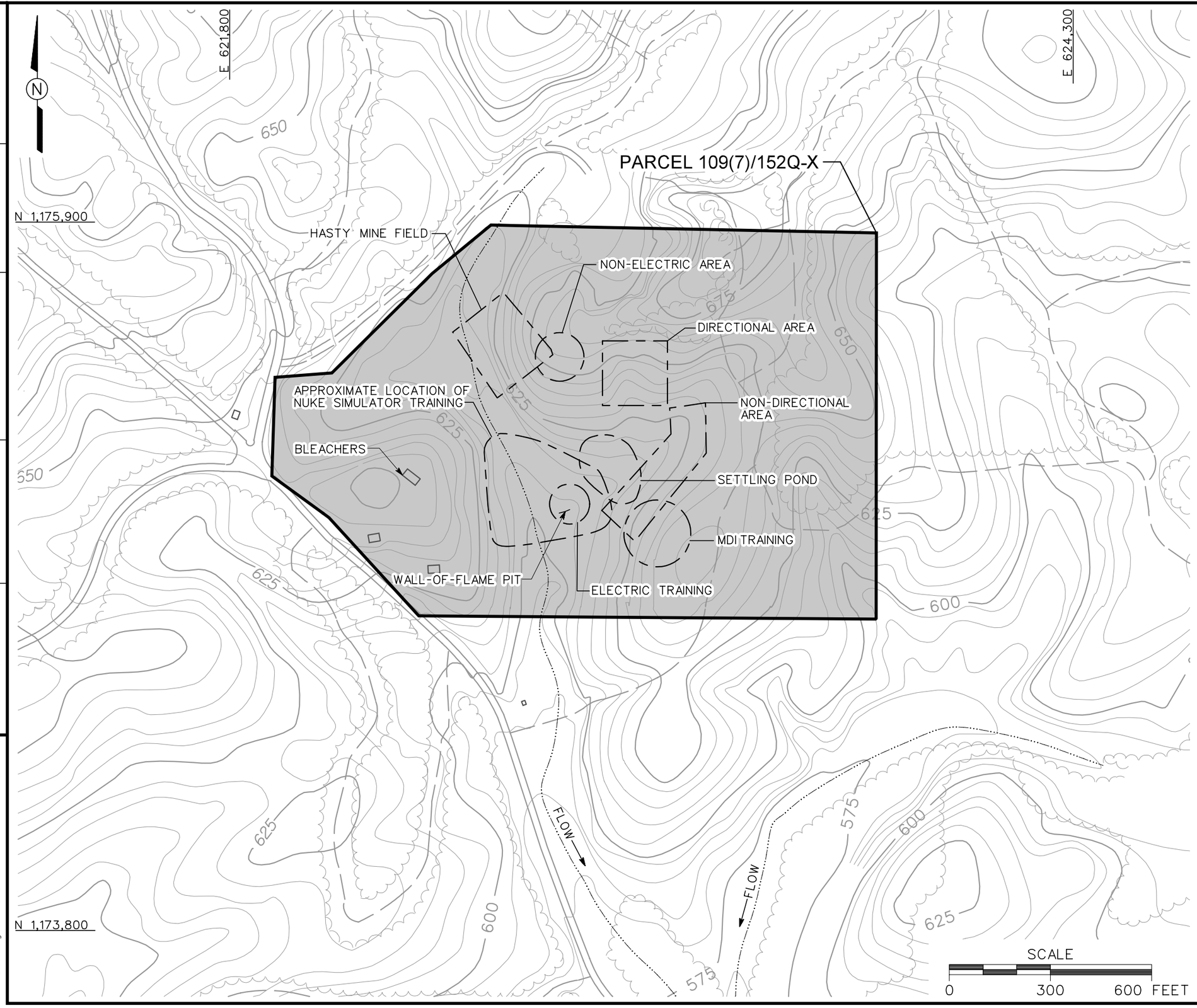

LEGEND:

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
- TREES / TREELINE
- PARCEL BOUNDARY
- SURFACE DRAINAGE / CREEK

SCALE
0 300 600 FEET

FIGURE 1-2
SITE MAP
RANGE 23A, MULTIPURPOSE RANGE
PARCEL 109(7)/152Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
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The former wall-of-flame training site is located south of the hasty mine field training area. Wall-of-flame training consisted of detonating approximately 300 gallons of a mixture of equal parts MOGAS and fog oil in an unlined earthen ditch approximately 2 to 3 feet wide, 2 feet deep, and 30 feet long (CH2M Hill, 2000). Training at the wall-of-flame area was discontinued in early 1996, and the ditch last used is no longer visible. It was reported that wall-of-flame training also occurred in at least one additional area at this range but a pit location is not visible. FFE training occurred at this range approximately 20 times per year (CH2M Hill, 2000).

A nuke-simulator training area was also located at this range. The former nuke-simulator site was reportedly located near an intermittent stream that flows south through the southwestern portion of the range (Figure 1-2). Nuke-simulator training was similar to wall-of-flame training, except that the earthen ditch was circular. Approximately 200 gallons of a mixture of equal parts MOGAS and fog oil were detonated in this circular ditch during each training exercise, which occurred only intermittently. This area of training is no longer visible (CH2M Hill, 2000).

The electric, nonelectric, and MDI training areas were associated with explosives training (Figure 1-2). Explosives used at the electric training area from August 1987 to 1999 included blasting caps (lead azide), trinitrotoluene (TNT), C-4, and pentaerythritol tetranitrate (PETN). Shock tubes (a combination of cyclotetramethylene tetranitramine and aluminum) were used for a few months beginning in June 1997 (CH2M Hill, 2000).

Explosives used at the non-electric training area since 1992 include blasting caps (lead azide, lead styphenate, and PETN), TNT, C-4, and PETN. The activities conducted at the non-electric training area were previously held at the hasty mine field training area from 1987 through 1992 (CH2M Hill, 2000).

Explosives used at the MDI training area since 1987 include blasting caps (lead azide, C-4, and PETN), TNT, C-4, PETN, tetryl bursting charges, and thermite (magnesium oxide) trip flares. Shock tubes were used in this area beginning in June 1997 (CH2M Hill, 2000).

A primary concern for any FFE training range was to control the potential spread of fire to nearby areas. Firebreaks were present at the site to control and contain the fires resulting from the training exercises. These firebreaks and the barren training areas were graded approximately every two years. Controlled burns were occasionally performed at the site to keep natural fuel sources to a minimum (CH2M Hill, 2000).

2.0 Previous Investigations

An EBS was conducted by ESE to document current environmental conditions of all FTMC property (ESE, 1998). The study was to identify sites that, based on available information, have no history of contamination and comply with DOD guidance for fast-track cleanup at closing installations. The EBS also provides a baseline picture of FTMC properties by identifying and categorizing the properties by seven criteria:

1. Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas)

2. Areas where only release or disposal of petroleum products has occurred

3. Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial response

4. Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions to protect human health and the environment have been taken

5. Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but all required remedial actions have not yet been taken

6. Areas where release, disposal, and/or migration of hazardous substances has occurred, but required actions have not yet been implemented

7. Areas that are not evaluated or require additional evaluation.

For non-CERCLA environmental or safety issues, the parcel label includes the following components: a unique non-CERCLA issue number; the letter "Q" designating the parcel as a Community Environmental Response Facilitation Act (CERFA) Category 1 Qualified parcel; and the code for the specific non-CERCLA issue(s) present (ESE, 1998). The non-CERCLA issue codes used are:

- A = Asbestos (in buildings)
- L = Lead-based paint (in buildings)
- P = Polychlorinated biphenyls
- R = Radon (in buildings)
- RD = Radionuclides/radiological issues
- X = UXO
- CWM = Chemical warfare material.

The EBS was conducted in accordance with CERFA protocols (CERFA-Public Law 102-426) and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, the Alabama Department of Environmental Management (ADEM), the U.S. Environmental Protection Agency (EPA) Region 4, and Calhoun County, as well as a database search of CERCLA-regulated substances, petroleum products, and Resource Conservation and Recovery Act-regulated facilities. Available historical maps and aerial photographs were reviewed to document historical land uses. Personal and telephone interviews of past and present FTMC employees and military personnel were conducted. In addition, visual site inspections were conducted to verify conditions of specific property parcels.

Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X, was identified as both a CERFA Category 7 parcel and a Category 1 Qualified parcel in the EBS. Category 7 parcels are areas that have not been evaluated or that require additional evaluation to determine their environmental condition. Category 1 Qualified parcels are areas that have no evidence of CERCLA-related hazardous substance storage, release, or disposal but that do have other environmental or safety concerns. Range 23A was qualified (X) for potential UXO because of range activities. Previous investigations have been conducted at Range 23A as discussed in the following paragraphs.

CHPPM, 1996. In 1996, the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM) conducted a preliminary site evaluation to determine if activities at Range 23A had contaminated groundwater or surface water, if such activities could adversely affect human health and the environment, and/or whether subsequent investigations were warranted. CHPPM concluded that the potential was high for surface water, groundwater, and soil contamination at Range 23A. A copy of the preliminary site evaluation is contained in the *Draft Range 23A Site Investigation Report* (CH2M Hill, 2000).

CH2M Hill, 1997 and 1999. In 1997 and 1999, CH2M Hill conducted preliminary SI activities to characterize the extent of potential contamination at Range 23A. During these investigations, a total of 12 surface soil samples, 9 subsurface soil samples, 4 groundwater samples, 3 surface water samples, and 4 sediment samples were collected for laboratory analysis. The sample locations are shown on Figure 2-1.

Soil and sediment samples were reported with detectable levels of metals, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), total petroleum hydrocarbon

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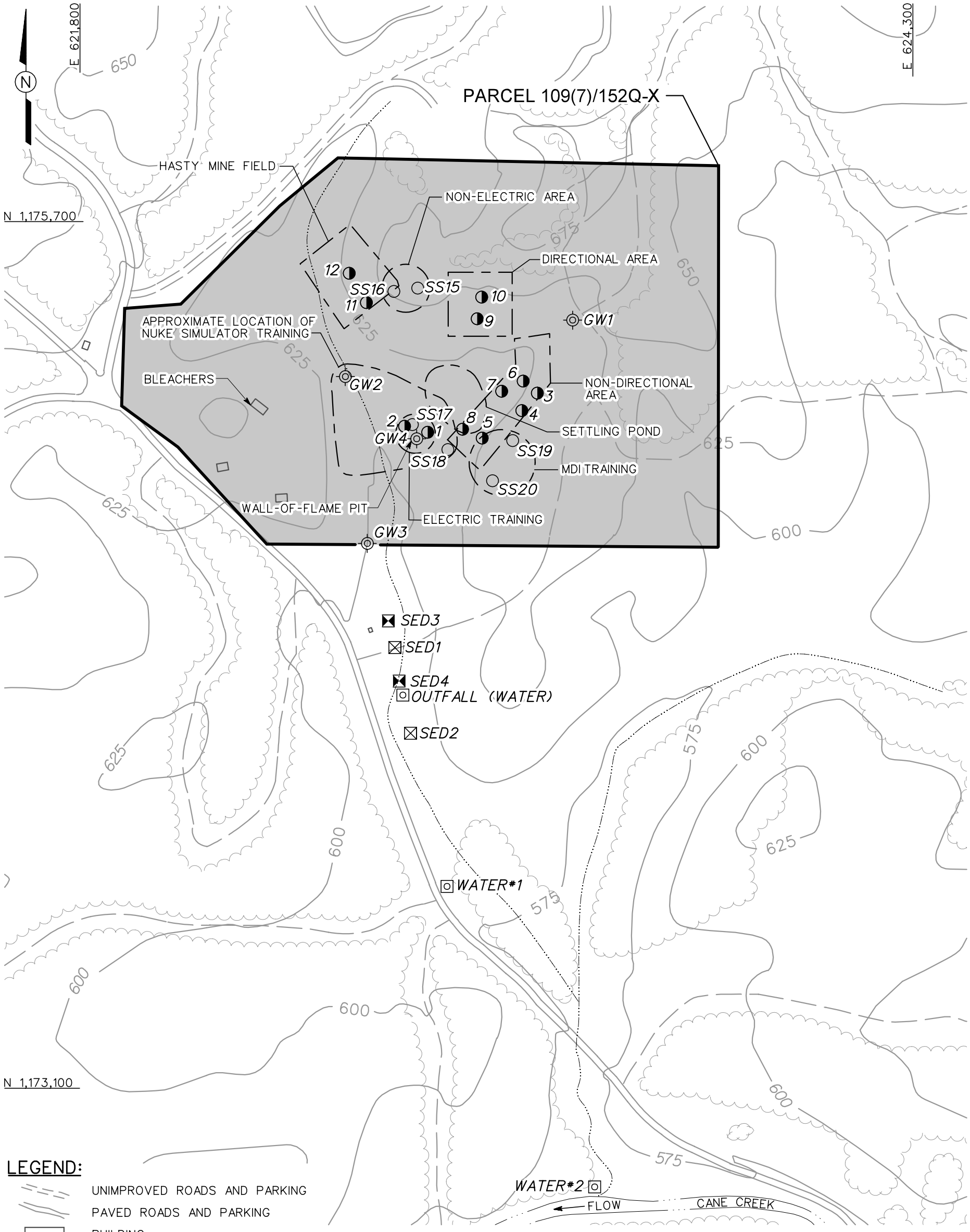

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- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 25 FOOT)
- TREES / TREELINE
- PARCEL BOUNDARY
- SURFACE DRAINAGE / CREEK
- TEMPORARY MONITORING WELL (ABANDONED)
- SEDIMENT SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION (APPROXIMATED)
- SOIL SAMPLE LOCATION
- SOIL SAMPLE LOCATION (APPROXIMATED)
- SURFACE WATER SAMPLE LOCATION (APPROXIMATED)

SCALE
0 300 600 FEET

FIGURE 2-1
SAMPLE LOCATION MAP
1997 / 1999 CH2M HILL INVESTIGATIONS
RANGE 23A, MULTIPURPOSE RANGE
PARCEL 109(7)/152Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
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compounds (TPH), and one explosive compound (hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX]). Water samples were reported with detectable levels of VOCs, metals, and one explosive compound (1,3-dinitrobenzene).

Soil samples collected by CH2M Hill were reanalyzed for explosive compounds because of laboratory quality assurance/quality control concerns. However, the reanalysis was completed outside of allowable holding times (CH2M Hill, 2000). Because of these concerns, the BCT decided that additional investigation was necessary at Range 23A.

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by Shaw at Range 23A, Parcel 109(7)/152Q-X, including UXO avoidance activities, environmental sampling and analysis, and groundwater monitoring well installation activities.

3.1 UXO Avoidance

UXO avoidance was performed at Range 23A following methodology outlined in the SAP. Shaw UXO personnel used a low-sensitivity magnetometer to perform a surface sweep of the parcel prior to site access. After the parcel was cleared for access, sample locations were monitored, following procedures outlined in the SAP.

3.2 Environmental Sampling

Environmental sampling performed during the SI at Range 23A included the collection of surface soil samples, subsurface soil samples, groundwater samples, and surface water/sediment samples for chemical analysis. Sample locations were determined based on previous investigation sample locations, by observing site physical characteristics during a site walkover, and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4.

3.2.1 Surface Soil Sampling

Eleven surface soil samples were collected at Range 23A, as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Soil sample designations and analytical parameters are listed in Table 3-2. Sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Surface soil samples were collected from the uppermost foot of soil using a direct-push technology (DPT) sampling system, following the methodology specified in the SAP. The samples were collected by first removing surface debris (e.g., rocks and vegetation) from the immediate sample area. The soil was then collected with the sampling device and screened with a photoionization detector (PID) in accordance with procedures outlined in the SAP. The soil fraction for VOC analysis was collected directly from the sampler using three EnCore® samplers. The remaining portion of the sample was transferred to a clean stainless-

Table 3-1

Sampling Locations and Rationale
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
RNG-109-GP01	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected from the Non-Electric Training Area, near existing sample location SS15, to indicate if contaminant releases into the environment have occurred from past training activities in the area.
RNG-109-GP02	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected from the Non-Electric training area, near its western boundary, at the location of existing sample location SS16 to indicate if contaminant releases into the environment have occurred from past training activities in the area.
RNG-109-GP03	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the Electric Training Area, near its northern boundary, at the location of existing sample location SS17 to indicate if contaminant releases into the environment have occurred from past training activities in the area.
RNG-109-GP04	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected just southeast of the Electric Training Area, downslope of existing sample location SS18, to indicate if contaminant releases into the environment have occurred from past training activities in the area.
RNG-109-GP05	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the northern portion of the MDI Training Area downslope of existing sample location SS19 to indicate if contaminant releases into the environment have occurred from past training activities in the area.
RNG-109-GP06	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected in the MDI Training Area, near its southern boundary, at the location of existing sample location SS20 to indicate if contaminant releases into the environment have occurred from past training activities in the area.
RNG-109-GP07	Surface soil and subsurface soil	Surface soil and subsurface soil samples were collected approximately 100 feet south (downslope) of existing soil sample location 9 to indicate if contaminants have been released into the environment and also help define the extent of toluene and ethylbenzene previously detected at location 9.
RNG-109-MW01	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected at the location of previous monitoring well GW1 to indicate if contaminant releases into the environment have occured from past training activities in the area.
RNG-109-MW02	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected in the northwest portion of the Nuke Simulator Training Area at the location of previous monitoring well GW2 to indicate if contaminant releases into the environment have occured from past training activities in the area.
RNG-109-MW03	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected at the location of previous monitoring well GW3 to indicate if contaminant releases into the environment have occured from past training activities in the area.
RNG-109-MW04	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil, and groundwater samples were collected near the southern portion of the Electric Training Area at the location of previous monitoring well GW4 to indicate if contaminant releases into the environment have occured from past training activities in the area.
RNG-109-SW/SD01	Surface water and sediment	Surface water and sediment samples were collected from the settling pond which receives storm water run-off from the directional and non-directional training areas. Sample data were used to indicate if contaminant releases into the environment have occurred from the storm water run-off.
RNG-109-SW/SD02	Surface water and sediment	Surface water and sediment samples were collected from the settling pond which receives storm water run-off from the directional and non-directional training areas. Sample data were used to indicate if contaminant releases into the environment have occurred from the storm water run-off.

Table 3-1

Sampling Locations and Rationale
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
RNG-109-SW/SD03	Surface water and sediment	Surface water and sediment samples were collected from the settling pond which receives storm water run-off from the directional and non-directional training areas. Sample data were used to indicate if contaminant releases into the environment have occurred from the storm water run-off.
RNG-109-SW/SD04	Surface water and sediment	Surface water and sediment samples were collected downstream of existing sediment sample location SED3, in an unnamed ditch leading to Cane Creek, to indicate if contaminant releases into the environment have occured from run-off in the area of Parcels 109(7)/152Q-X.
RNG-109-SW/SD05	Surface water and sediment	Surface water and sediment samples collected downstream of existing sediment sample location SED4, in an unnamed ditch leading to Cane Creek, to indicate if contaminant releases into the environment have occured from run-off in the area of Parcels 109(7)/152Q-X.
RNG-109-SW/SD06	Surface water and sediment	Surface water and sediment samples were collected downstream of the previous surface water sample location (water #1) to indicate if contaminant releases into the environment have occurred from run-off in the area of Parcels 109(7)/152Q-X.

Table 3-2

Soil Sample Designations and Analytical Parameters
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft)	QA/QC Samples		Analytical Parameters
			Field Duplicates	MS/MSD	
RNG-109-GP01	RNG-109-GP01-SS-NH0001-REG	0-1		RNG-109-GP01-SS-NH0001-MS/MSD	VOCs, SVOCs, Explosives, and Metals
	RNG-109-GP01-DS-NH0002-REG	10-11			
RNG-109-GP02	RNG-109-GP02-SS-NH0003-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-GP02-DS-NH0004-REG	9-10			
RNG-109-GP03	RNG-109-GP03-SS-NH0005-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-GP03-DS-NH0006-REG	7-8			
RNG-109-GP04	RNG-109-GP04-SS-NH0007-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-GP04-DS-NH0008-REG	11-12	RNG-109-GP04-DS-NH0009-FD		
RNG-109-GP05	RNG-109-GP05-SS-NH0010-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-GP05-DS-NH0011-REG	2-3			
RNG-109-GP06	RNG-109-GP06-SS-NH0012-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-GP06-DS-NH0013-REG	7-8			
RNG-109-GP07	RBG-109-GP07-SS-NH0014-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-GP07-DS-NH0015-REG	7-8			
RNG-109-MW01	RNG-109-MW01-SS-NH0016-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-MW01-DS-NH0017-REG	7-8			
RNG-109-MW02	RNG-109-MW02-SS-NH0018-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-MW02-DS-NH0019-REG	11-12	RNG-109-MW02-DS-NH0020-FD		
RNG-109-MW03	RNG-109-MW03-SS-NH0021-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-MW03-DS-NH0022-REG	3-4			
RNG-109-MW04	RNG-109-MW04-SS-NH0023-REG	0-1			VOCs, SVOCs, Explosives, and Metals
	RNG-109-MW04-DS-NH0024-REG	11-12			

ft - Feet.
FD - Field duplicate.
FS - Field split.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

DWG. NO.: ...\774645es.923
PROJ. NO.: 774645
INITIATOR: D. ALLAN
PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 05/10/02
DRAWN BY: D. BOMAR
1/28/2004 6:00:45 PM
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E 621,800

E 624,300

N 1,175,900

N 1,173,800

PARCEL 109(7)/152Q-X

HASTY MINE FIELD

NON-ELECTRIC AREA

DIRECTIONAL AREA

NON-DIRECTIONAL AREA

APPROXIMATE LOCATION OF NUKE SIMULATOR TRAINING

BLEACHERS

WALL-OF-FLAME PIT

SETTLING POND

MDI TRAINING

ELECTRIC TRAINING

RNG-109-GP01
RNG-109-GP02
RNG-109-GP03
RNG-109-GP04
RNG-109-GP05
RNG-109-GP06
RNG-109-GP07
RNG-109-MW01
RNG-109-MW02
RNG-109-MW03
RNG-109-MW04
RNG-109-SW/SD01
RNG-109-SW/SD02
RNG-109-SW/SD03
RNG-109-SW/SD04
RNG-109-SW/SD05
RNG-109-SW/SD06

FLOW

FLOW

650
675
625
650
625
650
625
600
625
600
575
600
625
575

LEGEND:

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 25 FOOT)
- TREES / TREELINE
- PARCEL BOUNDARY
- SURFACE DRAINAGE / CREEK
- MONITORING WELL / GROUNDWATER, SURFACE, AND SUBSURFACE SOIL SAMPLE LOCATION
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- SURFACE WATER/SEDIMENT SAMPLE LOCATION
- TEMPORARY MONITORING WELL (ABANDONED)
- EXISTING SEDIMENT SAMPLE LOCATION
- EXISTING SEDIMENT SAMPLE LOCATION (APPROXIMATED)
- EXISTING SOIL SAMPLE LOCATION
- EXISTING SOIL SAMPLE LOCATION (APPROXIMATED)
- EXISTING SURFACE WATER SAMPLE LOCATION (APPROXIMATED)

SCALE
0 300 600 FEET

FIGURE 3-1
SAMPLE LOCATION MAP
RANGE 23A, MULTIPURPOSE RANGE
PARCEL 109(7)/152Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw™ Shaw Environmental, Inc.

steel bowl, homogenized, and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples were collected from 11 soil borings at Range 23A, as shown on Figure 3-1. Subsurface soil sampling locations and rationale are presented in Table 3-1. Sample designations, depths, and analytical parameters are listed in Table 3-2. Soil boring locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Subsurface soil samples were collected from soil borings at depths greater than 1 foot below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and samples collected using the DPT sampling procedures specified in the SAP. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

Subsurface soil samples were collected continuously to 12 feet bgs or until DPT sampler refusal was encountered. Samples were field screened using a PID to measure for volatile organic vapors in accordance with procedures outlined in the SAP. The sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were below background, the deepest sample interval was submitted for analysis. The soil fraction for VOC analysis was collected directly from the sampler using three EnCore samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The on-site geologist constructed a detailed boring log for each soil boring (Appendix B). At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water, following borehole abandonment procedures summarized in the SAP.

3.2.3 Monitoring Well Installation

Four permanent groundwater monitoring wells were installed in the saturated zone at Range 23A to collect groundwater samples for laboratory analysis. The well/groundwater sampling locations are shown on Figure 3-1. Table 3-3 summarizes construction details of the wells installed at Range 23A. The well construction logs are included in Appendix B.

Shaw contracted Miller Drilling Company to install the permanent wells using a hollow-stem auger drill rig at four of the DPT soil boring locations. The wells were installed following

Table 3-3

Monitoring Well Construction Summary
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Well Location	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)	Well Material
RNG-109-MW01	1175412.70	623288.21	641.65	643.62	38	15	23 - 38	2" ID Sch. 40 PVC
RNG-109-MW02	1175265.70	622606.42	605.88	608.13	30	15	15 - 30	2" ID Sch. 40 PVC
RNG-109-MW03	1174763.33	622673.60	598.16	600.27	30	15	15 - 30	2" ID Sch. 40 PVC
RNG-109-MW04	1175053.46	622823.73	604.08	606.06	43	15	28 - 43	2" ID Sch. 40 PVC

Permanent wells installed using a hollow-stem auger drill rig.
Horizontal coordinates referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983.
Elevations referenced to the North American Vertical Datum of 1988.
2" ID Sch. 40 PVC - 2-inch inside diameter, Schedule 40, polyvinyl chloride.
amsl - Above mean sea level.
bgs - Below ground surface.
ft - Feet.

procedures outlined in the SAP. The borehole at each well location was advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the first water-bearing zone. A 2-foot-long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect residuum for observing and describing lithology. The on-site geologist logging the auger boreholes continued the lithological log for each borehole from the completion depth of the DPT borehole to the bottom of the auger borehole by logging the split-spoon samples. The split-spoon samples were logged to determine lithologic changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geological and hydrogeological information. Soil characteristics were described using the "Burmeister Identification System" described in Hunt (1986) and the Unified Soil Classification System as outlined in American Society for Testing and Materials (ASTM) Method D 2488 (ASTM, 2000). The boring logs are included in Appendix B.

Upon reaching the target depth in each borehole, a 15-foot length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with a PVC end cap was placed through the auger to the bottom of the borehole. The screen and end cap were attached to a 2-inch ID, flush-threaded Schedule 40 PVC riser. A filter pack consisting of number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was tremied around the well screen to approximately 5 feet above the top of the well screen as the augers were removed. The well was surged using a solid PVC surge block for approximately 10 minutes, or until no more settling of the filter sand occurred inside the borehole. A bentonite seal, consisting of approximately 2 feet of bentonite pellets, was placed immediately on top of the sand pack and hydrated with potable water. If the bentonite seal was installed below the water table surface, the bentonite pellets were allowed to hydrate in the groundwater. Bentonite seal placement and hydration followed procedures in the SAP. The remaining annular space of the well was filled with bentonite-cement grout. The well surface completion included installing a protective steel casing and concrete surface pad around the wellhead. A well cap was placed on the PVC well casing and the protective steel casing was secured with a lock.

The monitoring wells were developed by surging and pumping with a submersible pump in accordance with methodology outlined in the SAP. The submersible pump used for well development was moved in an up-and-down fashion to encourage any residual well installation materials to enter the well. These materials were then pumped out of the well to re-establish the natural hydraulic flow conditions. Development continued until the water turbidity was equal to or less than 20 nephelometric turbidity units, or for a maximum of 8 hours. The well development logs are included in Appendix C.

3.2.4 Water Level Measurements

The depth to groundwater was measured in wells installed at the site on January 7, 2002, following procedures outlined in the SAP. Depth to groundwater was measured with an electronic water level meter. The meter probe and cable were cleaned before use at each well following decontamination methodology presented in the SAP. Measurements were referenced to the top of the PVC casing. A summary of groundwater elevations is presented in Table 3-4.

3.2.5 Groundwater Sampling

Groundwater samples were collected from the four permanent monitoring wells installed at Range 23A. The well/groundwater sampling locations are shown on Figure 3-1. The groundwater sampling locations and rationale are listed in Table 3-1. The groundwater sample designations and analytical parameters are listed in Table 3-5.

Sample Collection. Groundwater sampling was performed following procedures outlined in the SAP. Purging and sampling were performed using either a peristaltic pump or a bladder pump equipped with Teflon™ tubing. RNG-109-MW04 was purged using a peristaltic pump and then sampled using a Teflon bailer. Samples for VOC analysis collected using a peristaltic pump were collected via the "tube evacuation" method described in the SAP (IT, 2002). Groundwater was sampled after purging a minimum of three well volumes and after field parameters (temperature, pH, specific conductivity, oxidation-reduction potential, dissolved oxygen, and turbidity) stabilized. Groundwater field parameters were measured after the completion of purging and prior to sample collection using a calibrated water quality meter. Field parameter readings are summarized in Table 3-6. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-5 using methods outlined in Section 3.4.

3.2.6 Surface Water Sampling

Six surface water samples were collected at Range 23A at the locations shown on Figure 3-1. The surface water sample locations and rationale are listed in Table 3-1. The surface water sample designations and analytical parameters are listed in Table 3-7. The sampling locations were determined in the field, based on drainage pathways and actual field observations.

Sample Collection. The surface water samples were collected in accordance with procedures specified in the SAP. The samples were collected by dipping a stainless-steel pitcher in the water and pouring the water into the sample containers or by dipping the containers in the water and allowing the water to fill the sample containers. Surface water samples were collected after

Table 3-4

Groundwater Elevations
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Well Location	Date	Depth to Water (ft BTOC)	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Groundwater Elevation (ft amsl)
RNG-109-MW01	07-Jan-02	30.44	643.62	641.65	613.18
RNG-109-MW02	07-Jan-02	15.92	608.13	605.88	592.21
RNG-109-MW03	07-Jan-02	20.00	600.27	598.16	580.27
RNG-109-MW04	07-Jan-02	13.15	606.06	604.08	592.91

Elevations referenced to the North American Vertical Datum of 1988.

amsl - Above mean sea level.
BTOC - Below top of casing.
ft - Feet.

Table 3-5

Groundwater Sample Designations and Analytical Parameters
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	QA/QC Samples		Analytical Parameters
		Field Duplicates	MS/MSD	
RNG-109-MW01	RNG-109-MW01-GW-NH3001-REG			VOCs, SVOCs, Explosives, and Metals
RNG-109-MW02	RNG-109-MW02-GW-NH3002-REG			VOCs, SVOCs, Explosives, and Metals
RNG-109-MW03	RNG-109-MW03-GW-NH3003-REG	RNG-109-MW03-GW-NH3005-FD	RNG-109-MW03-GW-NH3003-MS/MSD	VOCs, SVOCs, Explosives, and Metals
RNG-109-MW04	RNG-109-MW04-GW-NH3004-REG			VOCs, SVOCs, Explosives, and Metals

*Groundwater samples were collected from the approximate midpoint of the saturated screened interval of the monitoring well.

FD - Field duplicate.
FS - Field split.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

Table 3-6

Groundwater and Surface Water Field Parameters
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Date	Sample Media	Specific Conductivity (mS/cm)[a]	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTU)	pH (SU)
RNG-109-MW01	15-Mar-02	GW	0.027	5.0	371	19.1	4.1	4.4
RNG-109-MW02	26-Feb-02	GW	0.036	2.0	178	14.0	4.4	5.3
RNG-109-MW03	26-Feb-02	GW	0.026	5.6	329	13.6	1.2	4.7
RNG-109-MW04	26-Feb-02	GW	0.108	7.4	62	15.0	>1000	6.9
RNG-109-SW/SD01	21-Feb-02	SW	0.020	11.5	NR	13.4	68	6.7
RNG-109-SW/SD02	21-Feb-02	SW	0.021	10.9	NR	13.9	63	6.7
RNG-109-SW/SD03	21-Feb-02	SW	0.054	10.5	NR	13.0	65	5.1
RNG-109-SW/SD04	22-Feb-02	SW	0.059	9.8	210	8.4	96	5.7
RNG-109-SW/SD05	20-Feb-02	SW	0.032	8.7	185	13.6	53	6.1
RNG-109-SW/SD06	20-Feb-02	SW	0.023	7.0	180	13.2	8.3	5.1

[a] Specific conductivity values standardized to millisiemens per centimeter.

°C - Degrees Celsius.
GW - Groundwater.
mg/L - Milligrams per liter.
mS/cm - Millisiemens per centimeter.
mV - Millivolts.
NR - Not recorded due to equipment malfunction.
NTU - Nephelometric turbidity units.
ORP - Oxidation-reduction potential.
SU - Standard units.
SW - Surface water.

Table 3-7

Surface Water and Sediment Sample Designations and Analytical Parameters
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Matrix	QA/QC Samples		Analytical Parameters
			Field Duplicates	MS/MSD	
RNG-109-SW/SD01	RNG-109-SW/SD01-SW-NH2001-REG	Surface Water			VOCs, SVOCs, Explosives, and Metals. (TOC and Grain Size for sediment only)
	RNG-109-SW/SD01-SD-NH1001-REG	Sediment	RNG-109-SW/SD01-SD-NH1002-FD		
RNG-109-SW/SD02	RNG-109-SW/SD02-SW-NH2002-REG	Suface Water			VOCs, SVOCs, Explosives, and Metals. (TOC and Grain Size for sediment only)
	RNG-109-SW/SD02-SD-NH1003-REG	Sediment			
RNG-109-SW/SD03	RNG-109-SW/SD03-SW-NH2003-REG	Surface Water			VOCs, SVOCs, Explosives, and Metals. (TOC and Grain Size for sediment only)
	RNG-109-SW/SD03-SD-NH1004-REG	Sediment		RNG-109-SW/SD03-SD-NH1004-MS/MSD	
RNG-109-SW/SD04	RNG-109-SW/SD04-SW-NH2004-REG	Surface Water			VOCs, SVOCs, Explosives, and Metals. (TOC and Grain Size for sediment only)
	RNG-109-SW/SD04-SD-NH1005-REG	Sediment			
RNG-109-SW/SD05	RNG-109-SW/SD05-SW-NH2005-REG	Surface Water			VOCs, SVOCs, Explosives, and Metals. (TOC and Grain Size for sediment only)
	RNG-109-SW/SD05-SD-NH1006-REG	Sediment			
RNG-109-SW/SD06	RNG-109-SW/SD06-SW-NH2006-REG	Surface Water			VOCs, SVOCs, Explosives, and Metals. (TOC and Grain Size for sediment only)
	RNG-109-SW/SD06-SD-NH1007-REG	Sediment			

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOC - Semivolatile organic compound.
TOC - Total organic carbon.
VOC - Volatile organic compound.

field parameters had been measured using a calibrated water-quality meter. Surface water field parameters are listed in Table 3-6. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-7 using methods outlined in Section 3.4.

3.2.7 Sediment Sampling

Six sediment samples were collected at the same locations as the surface water samples presented in Section 3.2.6. The sediment sample locations are shown on Figure 3-1. The sampling locations and rationale are presented in Table 3-1. The sediment sample designations and analytical parameters are listed in Table 3-7. The actual sediment sampling locations were determined in the field, based on drainage pathways and actual field observations.

Sample Collection. Sediment samples were collected in accordance with the procedures specified in the SAP. Samples were collected from the upper 6 inches of sediment with a stainless-steel spoon and placed in a clean stainless-steel bowl. Samples for VOC analysis were then immediately collected from the stainless-steel bowl with three EnCore samplers. The remaining portion of the sample was homogenized and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The sediment samples were analyzed for the parameters listed in Table 3-7 using methods outlined in Section 3.4.

3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system survey techniques and conventional civil survey techniques described in the SAP. Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix D.

3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical parameters based on potential site-specific chemicals and on EPA, ADEM, FTMC, and USACE requirements. Samples collected at Range 23A were analyzed for the following parameters using EPA SW-846 methods, including Update III methods where applicable:

- Target analyte list metals – EPA Method 6010B/7470A/7471A
- Target compound list VOCs – EPA Method 8260B
- Target compound list SVOCs – EPA Method 8270C
- Nitroaromatic and nitramine explosives – EPA Method 8330.

The sediment samples were analyzed for the following additional parameters:

- Total organic carbon (TOC) – EPA Method 9060
- Grain size – ASTM Method D422.

3.5 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in Appendix B of the SAP. Sample documentation and chain-of-custody records were completed as specified in the SAP.

Completed analysis request and chain-of-custody records (Appendix A) were included with each shipment of sample coolers to EMAX Laboratories, Inc. in Torrance, California.

3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP. The IDW generated during the SI at Range 23A was segregated as follows:

- Drill cuttings
- Purge water from well development, sampling activities, and decontamination fluids
- Spent well materials and personal protective equipment (PPE).

Solid IDW was stored on site at Range 23A in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analyses. Based on the results, drill cuttings, spent well materials, and PPE generated during the SI at Range 23A were disposed as nonhazardous waste at the Three Corners Landfill in Piedmont, Alabama.

Liquid IDW was contained in the 20,000-gallon sump associated with the Building T-338 vehicle washrack. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonhazardous waste to the FTMC wastewater treatment plant on the Main Post.

3.7 Variances/Nonconformances

No variances or nonconformances to the SFSP were recorded during completion of the SI at Range 23A.

3.8 Data Quality

The field sample analytical data are presented in tabular form in Appendix E. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan; the FTMC SAP and installation-wide quality assurance plan; and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 2001) and the stipulated requirements for the generation of definitive data presented in the SAP. Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms.

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. The data validation results are summarized in a quality assurance report, which includes the data validation summary report (Appendix F). Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC Shaw Environmental Management System database for tracking and reporting. The qualified data were used in comparisons to the SSSLs and ESVs. Rejected data (assigned an "R" qualifier) were not used in comparisons to the SSSLs and ESVs. The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

4.0 Site Characterization

Subsurface investigations performed at Range 23A provided soil and groundwater data used to characterize the geology and hydrogeology of the site.

4.1 Regional and Site Geology

4.1.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted, with major structures and faults striking in a northeast-southwest direction.

Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults, and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992) and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984) but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper, undifferentiated Wilson Ridge and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish gray siltstone and mudstone. Massive to laminated greenish gray and black mudstone makes up the Nichols Formation, with thin interbeds of

siltstone and very fine-grained sandstone (Osborne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appears to dominate the unit and consists primarily of coarse-grained, vitreous quartzite and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists of sandy and micaceous shale and silty, micaceous mudstone, which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east, and southwest of the Main Post and consists of interlayered bluish gray or pale yellowish gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline, porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post, as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish red-purple mudstone, shale, siltstone, and greenish red and light gray sandstone, with locally occurring limestone and dolomite. Weaver Cave, located approximately one mile west of the northwest boundary of the Main Post, is situated in gray dolomite and limestone mapped as the Rome Formation (Osborne et al., 1997). The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark gray, finely to coarsely crystalline, medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded

to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped as undifferentiated at FTMC and in other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites, and limestones and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone, and glauconitic limestone (Osborne et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish gray to grayish red phosphatic shale, with increasing amounts of calcareous chert toward the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale based on fossil data.

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty, clay shale and mudstone with interbedded light to medium gray, very fine to fine grained, argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium to dark gray argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). The Parkwood Formation in Calhoun County is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovzal, 1974; Osborne et al., 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geologic feature in the vicinity of the Main Post of FTMC, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama, and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded window, or fenster, in the overlying thrust sheet. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation; north by the Conasauga Formation; northeast, east, and southwest by the Shady Dolomite; and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the FTMC window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the FTMC window and the Rome and Conasauga Formations. The trace of the Pell City fault is exposed approximately nine miles west of the FTMC window on Pelham Range, where it traverses northeast to southwest across the western quarter of Pelham Range. Here, the trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three-quarters of Pelham Range is located within the Pell City thrust sheet, while the remaining western quarter of Pelham is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks and is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the FTMC window and along the trace of the Pell City fault on

Pelham Range (Thomas and Neathery, 1982; Osborne et al., 1988). The Coosa deformed belt is a narrow northeast-to-southwest-trending linear zone of complex structure (approximately 5 to 20 miles wide and approximately 90 miles long) consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

4.1.2 Site Geology

The soil at Range 23A is classified as Clarksville cherty silt loam, 10 to 15 percent slope (U.S. Department of Agriculture, 1961). The Clarksville Series consists of well drained, strongly acidic soils that have developed in the residuum of cherty limestone. The surface soil is dark brown to dark grayish brown or very dark grayish brown cherty silt loam or stony loam. Fragments of chert and limestone, 3 to 8 inches or more in diameter are on the surface and in the profile (U.S. Department of Agriculture, 1961).

Bedrock was not encountered at the site but is mapped as the undifferentiated Cambrian/Ordovician Knox Group (Osborne et al., 1997). In the vicinity of Calhoun County, the Knox Group consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). Based on the boring logs from the four monitoring wells installed at the site, residuum at the site is predominantly light brown to light gray sand with some clay; some pinkish gray, fractured, angular chert; and trace silt and sandstone gravel. Hollow-stem auger refusal was not encountered during drilling at Range 23A.

4.2 Site Hydrology

4.2.1 Surface Hydrology

Precipitation in the form of rainfall averages about 53 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water feature at Pelham Range is Cane Creek, which flows to the west through the central portion of Pelham Range. Cane Creek and its associated tributaries drain almost all of Pelham Range. Other surface water features at Pelham Range include Lake Contreras, Cane Creek Lake, Willet Springs, and the Blue Hole (SAIC, 2000). Drainage from Cane Creek ultimately empties into the Coosa River on the western boundary of Calhoun County.

An unnamed tributary of Cane Creek flows south through the western side of the parcel and joins another unnamed tributary just south of Range 23A. These streams empty into Cane Creek, which is located approximately 2,000 feet south of the site. Surface water runoff at the site drains to the southeast, south, and southwest into the tributary of Cane Creek.

4.2.2 Hydrogeology

Static groundwater levels were measured in monitoring wells at Range 23A on January 7, 2002, as summarized in Table 3-4. Groundwater elevation at the site ranges from approximately 580 feet above mean sea level (amsl) to 615 feet amsl. Groundwater at Range 23A follows the general topography and flows southwest towards the tributary of Cane Creek (Figure 4-1).

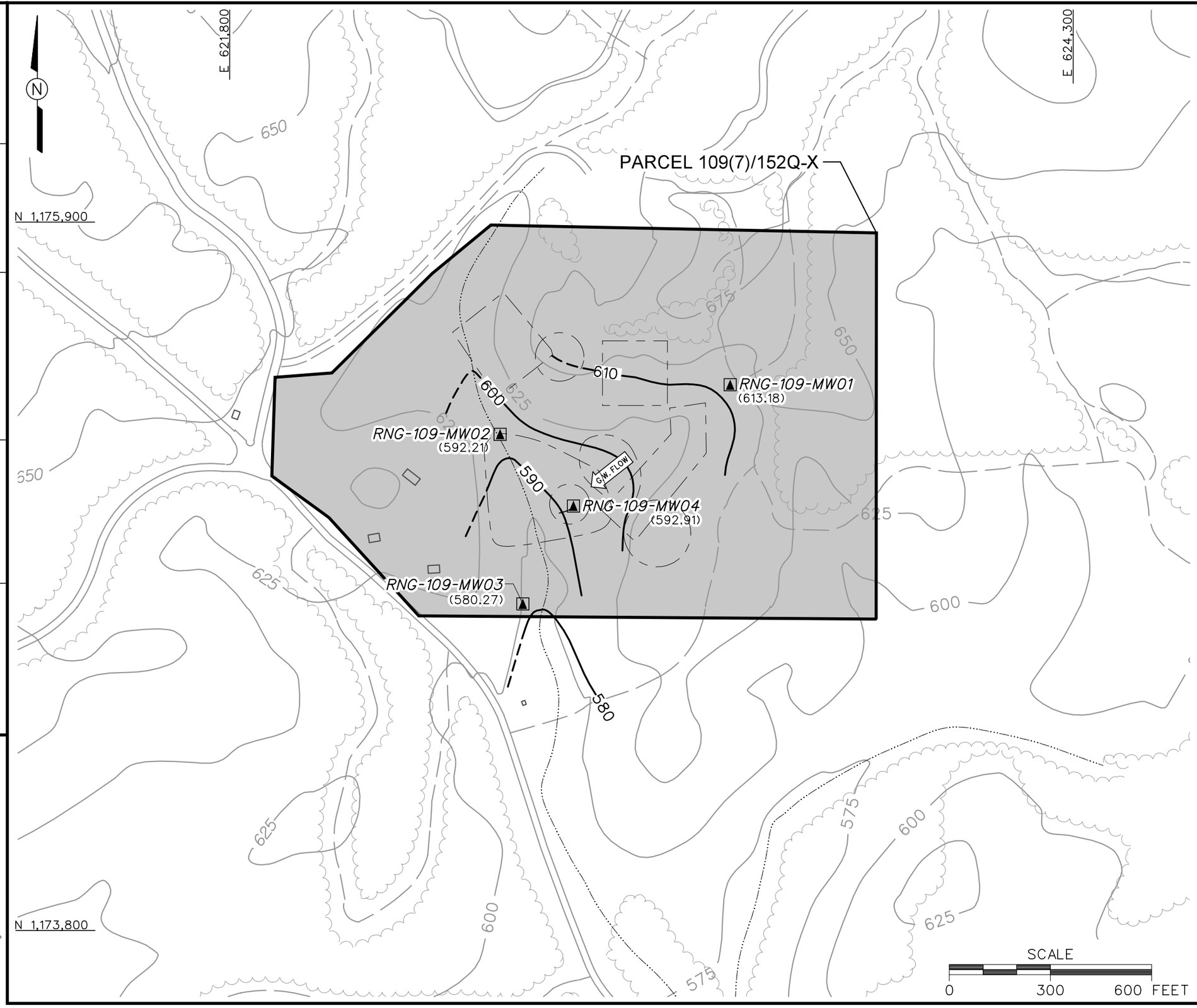

FIGURE 4-1
GROUNDWATER ELEVATIONS
RANGE 23A, MULTIPURPOSE RANGE
PARCEL 109(7)/152Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw™ Shaw Environmental, Inc.

DRAWN BY: D. BOMAR	DRAWN BY:	PROJ. MGR.: J. YACOUB	ENGR. CHCK. BY: S. MORAN	DRAFT. CHCK. BY:	INITIATOR: D. ALLAN
STARTING DATE: 05/10/02	DATE LAST REV.:				

DWG. NO.: ...\774645es.924
PROJ. NO.: 774645

1/28/2004 6:06:00 PM lstout
c:\cadd\Design\774645es.924

5.0 Summary of Analytical Results

The results of the chemical analysis of samples collected at Range 23A indicate that metals, VOCs, SVOCs, and one explosive compound were detected in site media. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, the analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed for human health and ecological risk evaluations as part of the on going SIs being performed under the BRAC Environmental Restoration Program at FTMC. A PERA was also performed to further characterize potential risks to ecological receptors.

Metals concentrations exceeding the SSSLs and ESVs were subsequently compared to metals background screening values to determine if the metals concentrations are within natural background concentrations (SAIC, 1998). Site metals data were further evaluated using statistical and geochemical methods to select site-related metals (Appendix G).

Six compounds were quantified by both SW-846 Method 8260B (as VOCs) and Method 8270C (as SVOCs), including 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene, hexachlorobutadiene, and naphthalene. Method 8260B yields a reporting limit (RL) of 0.005 milligrams per kilogram (mg/kg), while Method 8270C has an RL of 0.330 mg/kg, which is typical for a soil matrix sample. Because of the direct nature of the Method 8260B analysis and its resulting lower RL, this method should be considered superior to Method 8270C when quantifying low levels (0.005 to 0.330 mg/kg) of these compounds. Method 8270C and its associated methylene chloride extraction step is superior, however, when dealing with samples that contain higher concentrations (greater than 0.330 mg/kg) of these compounds. Therefore, all data were considered and none were categorically excluded. Data validation qualifiers were helpful in evaluating the usability of data, especially if calibration, blank contamination, precision, or accuracy indicator anomalies were encountered. The validation qualifiers and concentrations reported (e.g., whether concentrations were less than or greater than 0.330 mg/kg) were used to determine which analytical method was likely to return the more accurate result.

The following sections and Tables 5-1 through 5-5 summarize the results of the comparison of detected constituents to the SSSLs, ESVs, and background screening values. Complete analytical results are presented in Appendix E.

Table 5-1

Surface Soil Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location					RNG-109-GP01					RNG-109-GP02					RNG-109-GP03				
Sample Number					NH0001					NH0003					NH0005				
Sample Date					27-Nov-01					27-Nov-01					27-Nov-01				
Sample Depth (Feet)					0- 1					0- 1					0- 1				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	1.42E+04			YES	YES	9.08E+03			YES	YES	1.61E+04			YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	2.25E+01	J	YES	YES	YES	1.08E+01	J		YES	YES	2.32E+01	J	YES	YES	YES
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	1.98E+01					2.28E+01					2.94E+01				
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	5.72E-01	J				ND					ND				
Calcium	mg/kg	1.72E+03	NA	NA	1.17E+02	J				1.45E+02	J				7.38E+01	B			
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	1.81E+01	J			YES	9.27E+00	J			YES	2.01E+01	J			YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	4.07E+00					ND					2.62E+00	B			
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	1.92E+01		YES			8.62E+00					1.18E+01				
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	2.00E+04	J		YES	YES	9.31E+03	J		YES	YES	2.47E+04	J		YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	7.44E+00	J				7.43E+00	J				9.25E+00	J			
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	1.04E+03	J	YES			6.92E+02	J				6.88E+02	J			
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	5.64E+01	J				4.72E+01	J				4.28E+01	J			
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	ND					ND					ND				
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	1.16E+01		YES			3.40E+00	B				4.91E+00				
Potassium	mg/kg	8.00E+02	NA	NA	1.18E+03	J	YES			7.33E+02	J				5.18E+02	J			
Selenium	mg/kg	4.80E-01	3.91E+01	8.10E-01	8.96E-01	B	YES		YES	ND					6.69E-01	J	YES		
Silver	mg/kg	3.60E-01	3.91E+01	2.00E+00	1.83E+00	B	YES			ND					1.93E+00	J	YES		
Sodium	mg/kg	6.34E+02	NA	NA	4.25E+01	J				3.57E+01	J				3.38E+01	J			
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	3.33E+01	J			YES	1.78E+01	J			YES	3.84E+01	J			YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	6.68E+01	J	YES		YES	2.59E+01	J				3.39E+01	J			
VOLATILE ORGANIC COMPOUNDS																			
1,2,4-Trimethylbenzene	mg/kg	NA	3.88E+02	1.00E-01	ND					1.40E-03	J				ND				
1,2-Dimethylbenzene	mg/kg	NA	1.55E+04	5.00E-02	ND					ND					ND				
2-Butanone	mg/kg	NA	4.66E+03	8.96E+01	ND					ND					ND				
Acetone	mg/kg	NA	7.76E+02	2.50E+00	7.30E-03	B				1.10E-02	B				8.70E-03	B			
Toluene	mg/kg	NA	1.55E+03	5.00E-02	ND					1.70E-03	J				ND				
m,p-Xylenes	mg/kg	NA	1.55E+04	5.00E-02	ND					1.30E-03	J				ND				

Table 5-1

Surface Soil Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location					RNG-109-GP04					RNG-109-GP05					RNG-109-GP06				
Sample Number					NH0007					NH0010					NH0012				
Sample Date					27-Nov-01					27-Nov-01					26-Nov-01				
Sample Depth (Feet)					0- 1					0- 1					0- 1				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	1.19E+04			YES	YES	5.96E+03				YES	1.04E+04			YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	8.58E+00	J		YES		8.18E+00	J		YES		5.07E+00			YES	
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	3.63E+01					1.83E+01					3.27E+01				
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	ND					ND					ND				
Calcium	mg/kg	1.72E+03	NA	NA	1.30E+02	J				6.96E+01	B				1.57E+02				
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	1.19E+01	J			YES	7.49E+00	J			YES	1.07E+01				YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	4.91E+00					3.26E+00	B				5.77E+00				
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	8.05E+00					9.94E+00					8.06E+00				
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	1.17E+04	J		YES	YES	9.15E+03	J		YES	YES	8.89E+03			YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	1.05E+01	J				7.20E+00	J				7.86E+00				
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	5.98E+02	J				3.11E+02	J				4.90E+02				
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	3.34E+02	J			YES	1.45E+02	J			YES	3.02E+02				YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	ND					ND					ND				
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	5.09E+00	B				2.72E+00	B				7.86E+00				
Potassium	mg/kg	8.00E+02	NA	NA	4.21E+02	J				3.41E+02	J				2.94E+02	J			
Selenium	mg/kg	4.80E-01	3.91E+01	8.10E-01	6.74E-01	J	YES			6.76E-01	J	YES			8.09E-01	B	YES		
Silver	mg/kg	3.60E-01	3.91E+01	2.00E+00	1.44E+00	J	YES			ND					ND				
Sodium	mg/kg	6.34E+02	NA	NA	3.64E+01	J				3.46E+01	J				3.65E+01	J			
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	2.35E+01	J			YES	1.37E+01	J			YES	1.88E+01				YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	2.53E+01	J				1.15E+01	J				1.82E+01	J			
VOLATILE ORGANIC COMPOUNDS																			
1,2,4-Trimethylbenzene	mg/kg	NA	3.88E+02	1.00E-01	ND					2.10E-03	J				ND				
1,2-Dimethylbenzene	mg/kg	NA	1.55E+04	5.00E-02	ND					2.10E-03	J				ND				
2-Butanone	mg/kg	NA	4.66E+03	8.96E+01	6.20E-03	J				1.20E-02	J				ND				
Acetone	mg/kg	NA	7.76E+02	2.50E+00	6.20E-02	B				1.80E-01					8.20E-02	B			
Toluene	mg/kg	NA	1.55E+03	5.00E-02	ND					2.30E-03	J				ND				
m,p-Xylenes	mg/kg	NA	1.55E+04	5.00E-02	ND					4.00E-03	J				ND				

Table 5-1

Surface Soil Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location					RNG-109-GP07					RNG-109-MW01					RNG-109-MW02				
Sample Number					NH0014					NH0016					NH0018				
Sample Date					27-Nov-01					27-Nov-01					27-Nov-01				
Sample Depth (Feet)					0- 1					0- 1					0- 1				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	7.80E+03				YES	1.09E+04			YES	YES	1.62E+04			YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	1.25E+01	J		YES	YES	9.06E+00	J		YES		1.70E+01	J	YES	YES	YES
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	3.60E+01					2.22E+01					4.15E+01				
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	ND					ND					4.64E-01	J			
Calcium	mg/kg	1.72E+03	NA	NA	2.46E+02	J				1.53E+02	J				1.59E+02	J			
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	7.83E+00	J			YES	2.22E+01	J			YES	1.56E+01	J			YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	7.75E+00					3.53E+00	B				9.64E+00				
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	9.01E+00					8.46E+00					1.27E+01				
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	1.16E+04	J		YES	YES	1.86E+04	J		YES	YES	1.63E+04	J		YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	9.05E+00	J				7.30E+00	J				1.55E+01	J			
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	4.60E+02	J				4.89E+02	J				7.25E+02	J			
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	4.44E+02	J		YES	YES	9.78E+01	J				6.20E+02	J		YES	YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	3.90E-02	J				ND					ND				
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	4.98E+00	B				3.22E+00	B				6.87E+00	B			
Potassium	mg/kg	8.00E+02	NA	NA	3.74E+02	J				2.80E+02	J				6.14E+02	J			
Selenium	mg/kg	4.80E-01	3.91E+01	8.10E-01	7.04E-01	J	YES			ND					ND				
Silver	mg/kg	3.60E-01	3.91E+01	2.00E+00	1.65E+00	J	YES			1.29E+00	J	YES			ND				
Sodium	mg/kg	6.34E+02	NA	NA	3.80E+01	J				3.76E+01	J				4.57E+01	J			
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	1.67E+01	J			YES	3.61E+01	J			YES	3.52E+01	J			YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	3.34E+01	J				2.35E+01	J				4.05E+01	J			
VOLATILE ORGANIC COMPOUNDS																			
1,2,4-Trimethylbenzene	mg/kg	NA	3.88E+02	1.00E-01	ND					ND					ND				
1,2-Dimethylbenzene	mg/kg	NA	1.55E+04	5.00E-02	ND					ND					ND				
2-Butanone	mg/kg	NA	4.66E+03	8.96E+01	1.10E-02	J				ND					1.00E-02	J			
Acetone	mg/kg	NA	7.76E+02	2.50E+00	1.80E-01					4.50E-02	B				1.00E-01	J			
Toluene	mg/kg	NA	1.55E+03	5.00E-02	ND					ND					ND				
m,p-Xylenes	mg/kg	NA	1.55E+04	5.00E-02	ND					ND					ND				

Table 5-1

Surface Soil Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location					RNG-109-MW03					RNG-109-MW04				
Sample Number					NH0021					NH0023				
Sample Date					27-Nov-01					27-Nov-01				
Sample Depth (Feet)					0- 1					0- 1				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS														
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	1.12E+04			YES	YES	1.23E+04			YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	6.49E+00	J		YES		1.38E+01		YES	YES	YES
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	4.33E+01					2.70E+01				
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	3.98E-01	J				ND				
Calcium	mg/kg	1.72E+03	NA	NA	2.24E+02	J				1.56E+02				
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	9.46E+00	J			YES	1.57E+01				YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	6.88E+00					3.47E+00				
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	7.58E+00					8.91E+00				
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	8.10E+03	J		YES	YES	1.80E+04			YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	1.19E+01	J				8.86E+00				
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	4.99E+02	J				6.62E+02				
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	4.70E+02	J		YES	YES	1.54E+02				YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	ND					3.90E-02	B			
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	6.46E+00	B				6.23E+00				
Potassium	mg/kg	8.00E+02	NA	NA	3.03E+02	J				4.33E+02	J			
Selenium	mg/kg	4.80E-01	3.91E+01	8.10E-01	ND					8.11E-01	B	YES		YES
Silver	mg/kg	3.60E-01	3.91E+01	2.00E+00	1.42E+00	J	YES			1.54E+00	J	YES		
Sodium	mg/kg	6.34E+02	NA	NA	3.91E+01	J				3.88E+01	J			
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	1.74E+01	J			YES	3.45E+01				YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	2.57E+01	J				2.56E+01	J			
VOLATILE ORGANIC COMPOUNDS														
1,2,4-Trimethylbenzene	mg/kg	NA	3.88E+02	1.00E-01	ND					ND				
1,2-Dimethylbenzene	mg/kg	NA	1.55E+04	5.00E-02	ND					ND				
2-Butanone	mg/kg	NA	4.66E+03	8.96E+01	ND					ND				
Acetone	mg/kg	NA	7.76E+02	2.50E+00	6.20E-02	B				7.20E-03	J			
Toluene	mg/kg	NA	1.55E+03	5.00E-02	ND					ND				
m,p-Xylenes	mg/kg	NA	1.55E+04	5.00E-02	ND					ND				

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] Residential human health site-specific screening level (SSSL) and ecological screening value (ESV) as given in IT, 2000, *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Alabama*, July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit.

J - Compound was positively identified; reported value is an estimated concentration.

mg/kg - Milligrams per kilogram.

NA - Not available.

ND - Not detected.

Qual - Data validation qualifier.

Table 5-2

Subsurface Soil Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location				RNG-109-GP01				RNG-109-GP02				RNG-109-GP03				RNG-109-GP04			
Sample Number				NH0002				NH0004				NH0006				NH0008			
Sample Date				27-Nov-01				27-Nov-01				27-Nov-01				27-Nov-01			
Sample Depth (Feet)				10 - 11				9 - 10				7 - 8				11 - 12			
Parameter	Units	BKG[a]	SSSL[b]	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL
METALS																			
Aluminum	mg/kg	1.36E+04	7.80E+03	4.43E+03				4.63E+03				2.13E+04		YES	YES	2.36E+04		YES	YES
Arsenic	mg/kg	1.83E+01	4.26E-01	1.04E+01	J		YES	1.89E+01	J	YES	YES	2.82E+01	J	YES	YES	1.37E+01	J		YES
Barium	mg/kg	2.34E+02	5.47E+02	5.29E+00				2.20E+02				2.03E+01				2.75E+01			
Beryllium	mg/kg	8.60E-01	9.60E+00	6.66E-01	J			8.78E-01	J	YES		ND				ND			
Cadmium	mg/kg	2.20E-01	6.25E+00	ND				9.17E-01	J	YES		ND				ND			
Calcium	mg/kg	6.37E+02	NA	3.63E+01	B			2.66E+01	B			1.87E+01	B			1.14E+02	J		
Chromium	mg/kg	3.83E+01	2.32E+01	5.20E+00	J			4.95E+00	J			3.51E+01	J		YES	2.12E+01	J		
Cobalt	mg/kg	1.75E+01	4.68E+02	1.27E+01				1.39E+01				2.52E+00	B			2.08E+00	B		
Copper	mg/kg	1.94E+01	3.13E+02	1.99E+01		YES		2.29E+01		YES		1.64E+01				1.47E+01			
Iron	mg/kg	4.48E+04	2.34E+03	1.27E+04	J		YES	1.17E+04	J		YES	4.19E+04	J		YES	1.93E+04	J		YES
Lead	mg/kg	3.85E+01	4.00E+02	1.21E+01	J			1.29E+02	J	YES		7.80E+00	J			9.62E+00	J		
Magnesium	mg/kg	7.66E+02	NA	3.69E+02	J			5.73E+02	J			5.68E+02	J			8.73E+02	J	YES	
Manganese	mg/kg	1.36E+03	3.63E+02	1.15E+02	J			1.85E+03	J	YES	YES	1.22E+01	J			5.17E+01	J		
Mercury	mg/kg	7.00E-02	2.33E+00	ND				7.50E-02	J	YES		1.18E-01	J	YES		4.70E-02	J		
Nickel	mg/kg	1.29E+01	1.54E+02	1.53E+01		YES		2.55E+01		YES		3.38E+00	B			6.38E+00			
Potassium	mg/kg	7.11E+02	NA	8.15E+02	J	YES		1.27E+03	J	YES		4.04E+02	J			6.42E+02	J		
Selenium	mg/kg	4.70E-01	3.91E+01	ND				ND				1.75E+00		YES		ND			
Silver	mg/kg	2.40E-01	3.91E+01	ND				ND				3.25E+00	J	YES		1.72E+00	J	YES	
Sodium	mg/kg	7.02E+02	NA	3.70E+01	J			4.12E+01	J			3.81E+01	J			8.70E+01	J		
Thallium	mg/kg	1.40E+00	5.08E-01	ND				ND				ND				ND			
Vanadium	mg/kg	6.49E+01	5.31E+01	1.36E+01	J			1.95E+01	J			6.28E+01	J		YES	4.06E+01	J		
Zinc	mg/kg	3.49E+01	2.34E+03	9.23E+01	J	YES		1.14E+02	J	YES		2.40E+01	J			3.25E+01	J		
VOLATILE ORGANIC COMPOUNDS																			
1,2,4-Trimethylbenzene	mg/kg	NA	3.88E+02	ND				ND				ND				3.90E+01			
1,2-Dimethylbenzene	mg/kg	NA	1.55E+04	ND				ND				ND				1.10E+01			
1,3,5-Trimethylbenzene	mg/kg	NA	3.88E+02	ND				ND				ND				1.30E+01			
2-Butanone	mg/kg	NA	4.66E+03	ND				ND				ND				ND			
Acetone	mg/kg	NA	7.76E+02	ND				8.50E-03	B			1.70E-02	B			ND			
Benzene	mg/kg	NA	2.17E+01	ND				ND				ND				ND			
Cumene	mg/kg	NA	7.77E+02	ND				ND				ND				1.10E+00			
Ethylbenzene	mg/kg	NA	7.77E+02	ND				ND				ND				7.00E+00			
Naphthalene	mg/kg	NA	1.55E+02	ND				ND				ND				2.20E+00			
Toluene	mg/kg	NA	1.55E+03	ND				ND				ND				5.20E-01			
Trichlorofluoromethane	mg/kg	NA	2.33E+03	ND				ND				ND				ND			
m,p-Xylenes	mg/kg	NA	1.55E+04	ND				ND				ND				1.60E+01			
n-Propylbenzene	mg/kg	NA	7.77E+01	ND				ND				ND				5.60E+00			
p-Cymene	mg/kg	NA	1.55E+03	ND				ND				ND				6.30E-01			
sec-Butylbenzene	mg/kg	NA	7.77E+01	ND				ND				ND				7.50E-01			
SEMIVOLATILE ORGANIC COMPOUNDS																			
2-Methylnaphthalene	mg/kg	NA	1.55E+02	ND				ND				ND				1.70E+00	J		
Fluorene	mg/kg	NA	3.09E+02	ND				ND				ND				1.30E-01	J		
Naphthalene	mg/kg	NA	1.55E+02	ND				ND				ND				5.40E-01	J		
Phenanthrene	mg/kg	NA	2.32E+03	ND				ND				ND				3.40E-01	J		

Table 5-2

Subsurface Soil Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location				RNG-109-GP05				RNG-109-GP06				RNG-109-GP07				RNG-109-MW01			
Sample Number				NH0011				NH0013				NH0015				NH0017			
Sample Date				27-Nov-01				26-Nov-01				27-Nov-01				27-Nov-01			
Sample Depth (Feet)				2 - 3				2 - 4				7 - 8				7 - 8			
Parameter	Units	BKG[a]	SSSL[b]	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL
METALS																			
Aluminum	mg/kg	1.36E+04	7.80E+03	6.38E+03				5.73E+03				7.30E+03				3.61E+03			
Arsenic	mg/kg	1.83E+01	4.26E-01	1.38E+01	J		YES	7.54E+00			YES	1.96E+01	J	YES	YES	5.15E+00	J		YES
Barium	mg/kg	2.34E+02	5.47E+02	2.40E+01				1.00E+03		YES	YES	7.60E+00				3.65E+00			
Beryllium	mg/kg	8.60E-01	9.60E+00	ND				ND				ND				4.23E-01	J		
Cadmium	mg/kg	2.20E-01	6.25E+00	ND				7.89E-01	J	YES		ND				ND			
Calcium	mg/kg	6.37E+02	NA	8.33E+01	J			6.31E+01	J			7.12E+01	B			5.20E+01	B		
Chromium	mg/kg	3.83E+01	2.32E+01	1.27E+01	J			6.36E+00				1.60E+01	J			1.45E+01	J		
Cobalt	mg/kg	1.75E+01	4.68E+02	1.12E+01				3.11E+01		YES		1.53E+00	B			4.57E+00			
Copper	mg/kg	1.94E+01	3.13E+02	1.38E+01				2.83E+01		YES		9.24E+00				1.58E+01			
Iron	mg/kg	4.48E+04	2.34E+03	1.41E+04	J		YES	7.42E+03			YES	1.85E+04	J		YES	1.45E+04	J		YES
Lead	mg/kg	3.85E+01	4.00E+02	1.19E+01	J			3.24E+01				4.07E+00	J			7.13E+00	J		
Magnesium	mg/kg	7.66E+02	NA	3.15E+02	J			2.24E+02				2.94E+02	J			1.91E+02	J		
Manganese	mg/kg	1.36E+03	3.63E+02	4.24E+02	J		YES	1.03E+04		YES	YES	4.50E+01	J			4.77E+01	J		
Mercury	mg/kg	7.00E-02	2.33E+00	ND				1.07E-01	J	YES		ND				ND			
Nickel	mg/kg	1.29E+01	1.54E+02	5.73E+00				8.74E+00				2.73E+00	B			8.02E+00			
Potassium	mg/kg	7.11E+02	NA	4.56E+02	J			5.16E+02	J			4.19E+02	J			3.58E+02	J		
Selenium	mg/kg	4.70E-01	3.91E+01	ND				ND				ND				ND			
Silver	mg/kg	2.40E-01	3.91E+01	1.26E+00	J	YES		ND				2.25E+00	J	YES		1.69E+00	J	YES	
Sodium	mg/kg	7.02E+02	NA	2.84E+01	J			5.59E+01	J			3.53E+01	J			3.68E+01	J		
Thallium	mg/kg	1.40E+00	5.08E-01	ND				5.52E+00		YES	YES	ND				ND			
Vanadium	mg/kg	6.49E+01	5.31E+01	1.72E+01	J			1.95E+01				2.60E+01	J			2.04E+01	J		
Zinc	mg/kg	3.49E+01	2.34E+03	1.98E+01	J			3.83E+01	J	YES		2.67E+01	J			5.83E+01	J	YES	
VOLATILE ORGANIC COMPOUNDS																			
1,2,4-Trimethylbenzene	mg/kg	NA	3.88E+02	1.10E-03	J			ND				ND				ND			
1,2-Dimethylbenzene	mg/kg	NA	1.55E+04	ND				ND				ND				ND			
1,3,5-Trimethylbenzene	mg/kg	NA	3.88E+02	ND				ND				ND				ND			
2-Butanone	mg/kg	NA	4.66E+03	8.50E-03	J			ND				4.80E-03	J			ND			
Acetone	mg/kg	NA	7.76E+02	4.60E-02	B			3.70E-03	B			2.40E-02	B			8.10E-03	B		
Benzene	mg/kg	NA	2.17E+01	ND				ND				ND				ND			
Cumene	mg/kg	NA	7.77E+02	ND				ND				ND				ND			
Ethylbenzene	mg/kg	NA	7.77E+02	ND				ND				ND				ND			
Naphthalene	mg/kg	NA	1.55E+02	ND				ND				ND				ND			
Toluene	mg/kg	NA	1.55E+03	9.90E-04	J			ND				ND				ND			
Trichlorofluoromethane	mg/kg	NA	2.33E+03	ND				1.60E-03	B			ND				ND			
m,p-Xylenes	mg/kg	NA	1.55E+04	1.70E-03	J			ND				ND				ND			
n-Propylbenzene	mg/kg	NA	7.77E+01	ND				ND				ND				ND			
p-Cymene	mg/kg	NA	1.55E+03	ND				ND				ND				ND			
sec-Butylbenzene	mg/kg	NA	7.77E+01	ND				ND				ND				ND			
SEMIVOLATILE ORGANIC COMPOUNDS																			
2-Methylnaphthalene	mg/kg	NA	1.55E+02	ND				ND				ND				ND			
Fluorene	mg/kg	NA	3.09E+02	ND				ND				ND				ND			
Naphthalene	mg/kg	NA	1.55E+02	ND				ND				ND				ND			
Phenanthrene	mg/kg	NA	2.32E+03	ND				ND				ND				ND			

Table 5-2

Subsurface Soil Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location				RNG-109-MW02				RNG-109-MW03				RNG-109-MW04			
Sample Number				NH0019				NH0022				NH0024			
Sample Date				27-Nov-01				27-Nov-01				27-Nov-01			
Sample Depth (Feet)				11 - 12				3 - 4				11 - 12			
Parameter	Units	BKG[a]	SSSL[b]	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL
METALS															
Aluminum	mg/kg	1.36E+04	7.80E+03	5.06E+03				1.55E+04		YES	YES	9.79E+03			YES
Arsenic	mg/kg	1.83E+01	4.26E-01	2.22E+01	J	YES	YES	6.49E+00	J		YES	1.45E+01			YES
Barium	mg/kg	2.34E+02	5.47E+02	1.75E+01				3.17E+01				7.65E+00			
Beryllium	mg/kg	8.60E-01	9.60E+00	ND				ND				ND			
Cadmium	mg/kg	2.20E-01	6.25E+00	ND				ND				ND			
Calcium	mg/kg	6.37E+02	NA	2.79E+01	B			1.15E+02	J			5.28E+01	J		
Chromium	mg/kg	3.83E+01	2.32E+01	2.17E+01	J			1.19E+01	J			2.23E+01			
Cobalt	mg/kg	1.75E+01	4.68E+02	1.09E+01				5.05E+00				1.86E+00	B		
Copper	mg/kg	1.94E+01	3.13E+02	4.06E+01	J	YES		1.07E+01				8.66E+00			
Iron	mg/kg	4.48E+04	2.34E+03	1.09E+04	J		YES	1.06E+04	J		YES	3.01E+04			YES
Lead	mg/kg	3.85E+01	4.00E+02	2.13E+01	J			9.68E+00	J			8.39E+00			
Magnesium	mg/kg	7.66E+02	NA	2.55E+02	J			7.10E+02	J			2.86E+02			
Manganese	mg/kg	1.36E+03	3.63E+02	2.85E+02	J			6.89E+01	J			3.86E+01			
Mercury	mg/kg	7.00E-02	2.33E+00	ND				4.20E-02	J			5.60E-02	B		
Nickel	mg/kg	1.29E+01	1.54E+02	1.07E+01				6.71E+00	B			2.43E+00	B		
Potassium	mg/kg	7.11E+02	NA	4.17E+02	J			3.67E+02	J			2.22E+02	J		
Selenium	mg/kg	4.70E-01	3.91E+01	ND				6.22E-01	B	YES		6.72E-01	B	YES	
Silver	mg/kg	2.40E-01	3.91E+01	ND				ND				1.66E+00	J	YES	
Sodium	mg/kg	7.02E+02	NA	3.22E+01	J			5.30E+01	J			3.77E+01	J		
Thallium	mg/kg	1.40E+00	5.08E-01	ND				ND				ND			
Vanadium	mg/kg	6.49E+01	5.31E+01	1.80E+01	J			2.45E+01	J			3.99E+01			
Zinc	mg/kg	3.49E+01	2.34E+03	3.40E+01	J			2.69E+01	J			1.25E+01	J		
VOLATILE ORGANIC COMPOUNDS															
1,2,4-Trimethylbenzene	mg/kg	NA	3.88E+02	ND				ND				3.40E-03	J		
1,2-Dimethylbenzene	mg/kg	NA	1.55E+04	ND				ND				ND			
1,3,5-Trimethylbenzene	mg/kg	NA	3.88E+02	ND				ND				ND			
2-Butanone	mg/kg	NA	4.66E+03	ND				ND				ND			
Acetone	mg/kg	NA	7.76E+02	8.10E-03	B			1.10E-02	B			ND			
Benzene	mg/kg	NA	2.17E+01	ND				ND				2.50E-03	J		
Cumene	mg/kg	NA	7.77E+02	ND				ND				ND			
Ethylbenzene	mg/kg	NA	7.77E+02	ND				ND				ND			
Naphthalene	mg/kg	NA	1.55E+02	ND				ND				ND			
Toluene	mg/kg	NA	1.55E+03	ND				ND				ND			
Trichlorofluoromethane	mg/kg	NA	2.33E+03	ND				ND				ND			
m,p-Xylenes	mg/kg	NA	1.55E+04	ND				ND				ND			
n-Propylbenzene	mg/kg	NA	7.77E+01	ND				ND				ND			
p-Cymene	mg/kg	NA	1.55E+03	ND				ND				ND			
sec-Butylbenzene	mg/kg	NA	7.77E+01	ND				ND				ND			
SEMIVOLATILE ORGANIC COMPOUNDS															
2-Methylnaphthalene	mg/kg	NA	1.55E+02	ND				ND				ND			
Fluorene	mg/kg	NA	3.09E+02	ND				ND				ND			
Naphthalene	mg/kg	NA	1.55E+02	ND				ND				ND			
Phenanthrene	mg/kg	NA	2.32E+03	ND				ND				ND			

Table 5-2

Subsurface Soil Analytical Results
Range 23A: Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] Residential human health site-specific screening level (SSSL) as given in IT Corporation (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit.

J - Compound was positively identified; reported value is an estimated concentration.

mg/kg - Milligrams per kilogram.

NA - Not available.

ND - Not detected.

Qual - Data validation qualifier.

Table 5-3

Groundwater Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location				RNG-109-MW01				RNG-109-MW02				RNG-109-MW03				RNG-109-MW04			
Sample Number				NH3001				NH3002				NH3003				NH3004			
Sample Date				15-Mar-02				26-Feb-02				26-Feb-02				26-Feb-02			
Parameter	Units	BKG[a]	SSSL[b]	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL
METALS																			
Aluminum	mg/L	2.34E+00	1.56E+00	4.13E-01				7.98E-02	J			1.27E-01	J			1.97E+01		YES	YES
Arsenic	mg/L	1.78E-02	4.40E-05	ND				2.19E-03	J		YES	ND				1.32E-02			YES
Barium	mg/L	1.27E-01	1.10E-01	2.43E-02				1.71E-02				1.30E-02				1.36E-01		YES	YES
Beryllium	mg/L	1.25E-03	3.13E-03	ND				ND				ND				3.66E-03	J	YES	YES
Calcium	mg/L	5.65E+01	NA	ND				6.52E-01	J			6.61E-01	J			8.41E+00			
Chromium	mg/L	NA	4.69E-03	ND				ND				ND				6.56E-03	J		YES
Cobalt	mg/L	2.34E-02	9.39E-02	ND				3.02E-02		YES		ND				6.11E-02		YES	
Copper	mg/L	2.55E-02	6.26E-02	ND				ND				ND				3.43E-02		YES	
Iron	mg/L	7.04E+00	4.69E-01	1.39E-01	J			4.00E+00			YES	4.08E-02	J			1.69E+01		YES	YES
Lead	mg/L	8.00E-03	1.50E-02	ND				ND				ND				4.30E-02		YES	YES
Magnesium	mg/L	2.13E+01	NA	2.28E-01	B			3.45E-01	J			7.33E-01	J			4.91E+00			
Manganese	mg/L	5.81E-01	7.35E-02	1.47E-01			YES	8.67E-01		YES	YES	2.73E-02	J			1.43E+00		YES	YES
Mercury	mg/L	NA	4.69E-04	ND				ND				ND				2.74E-04	J		
Nickel	mg/L	NA	3.13E-02	ND				1.64E-02	J			ND				4.30E-02			YES
Potassium	mg/L	7.20E+00	NA	ND				ND				ND				3.78E+00	B		
Sodium	mg/L	1.48E+01	NA	1.33E+00	B			4.08E+00				1.04E+00				4.57E+01		YES	
Thallium	mg/L	1.46E-03	1.01E-04	ND				ND				7.03E-03	B	YES	YES	ND			
Vanadium	mg/L	1.70E-02	1.10E-02	ND				ND				ND				2.01E-02		YES	YES
Zinc	mg/L	2.20E-01	4.69E-01	ND				ND				ND				1.35E-01			
VOLATILE ORGANIC COMPOUNDS																			
Acetone	mg/L	NA	1.56E-01	ND				7.20E-01	J		YES	ND				ND			
Methylene chloride	mg/L	NA	7.85E-03	ND				3.60E-04	B			ND				ND			

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] Residential human health site-specific screening level (SSSL) as given in IT Corporation (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit.
J - Compound was positively identified; reported value is an estimated concentration.
mg/L - Milligrams per liter.
NA - Not available.
ND - Not detected.
Qual - Data validation qualifier.

Table 5-4

Surface Water Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location					RNG-109-SW/SD01					RNG-109-SW/SD02					RNG-109-SW/SD03				
Sample Number					NH2001					NH2002					NH2003				
Sample Date					21-Feb-02					21-Feb-02					21-Feb-02				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/L	5.26E+00	1.53E+01	8.70E-02	1.96E+00				YES	1.95E+00				YES	1.93E+00				YES
Arsenic	mg/L	2.17E-03	7.30E-04	1.90E-01	ND					ND					1.93E-03	J		YES	
Barium	mg/L	7.54E-02	1.10E+00	3.90E-03	2.01E-02				YES	1.96E-02				YES	2.04E-02				YES
Calcium	mg/L	2.52E+01	NA	1.16E+02	1.78E+00					1.76E+00					1.84E+00				
Cobalt	mg/L	NA	9.31E-01	3.00E-03	1.70E-02	J			YES	ND					1.16E-02	J			YES
Iron	mg/L	1.96E+01	4.70E+00	1.00E+00	1.11E+00				YES	9.60E-01	J				1.04E+00				YES
Magnesium	mg/L	1.10E+01	NA	8.20E+01	6.77E-01	J				6.90E-01	J				7.21E-01	J			
Manganese	mg/L	5.65E-01	6.40E-01	8.00E-02	1.87E-01				YES	1.91E-01				YES	1.95E-01				YES
Potassium	mg/L	2.56E+00	NA	5.30E+01	ND					ND					ND				
Sodium	mg/L	3.44E+00	NA	6.80E+02	5.34E-01	B				5.38E-01	B				5.34E-01	B			
Thallium	mg/L	2.49E-03	1.02E-03	4.00E-03	3.70E-03	B	YES	YES		ND					ND				
VOLATILE ORGANIC COMPOUNDS																			
Acetone	mg/L	NA	1.57E+00	7.80E+01	ND					ND					1.80E-02	J			
Methylene chloride	mg/L	NA	1.42E-01	1.93E+00	ND					ND					2.30E-04	B			
EXPLOSIVES																			
RDX	mg/L	NA	1.10E-02	1.90E-01	2.90E-03					2.50E-03					1.80E-03				

Table 5-4

Surface Water Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location					RNG-109-SW/SD04					RNG-109-SW/SD05					RNG-109-SW/SD06				
Sample Number					NH2004					NH2005					NH2006				
Sample Date					22-Feb-02					20-Feb-02					20-Feb-02				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/L	5.26E+00	1.53E+01	8.70E-02	3.37E+00				YES	1.01E+00				YES	1.96E-01	J			YES
Arsenic	mg/L	2.17E-03	7.30E-04	1.90E-01	3.63E-03	J	YES	YES		ND					ND				
Barium	mg/L	7.54E-02	1.10E+00	3.90E-03	3.00E-02				YES	2.44E-02				YES	3.06E-02				YES
Calcium	mg/L	2.52E+01	NA	1.16E+02	4.27E+00					2.77E+00					2.17E+00				
Cobalt	mg/L	NA	9.31E-01	3.00E-03	1.46E-02	J			YES	ND					ND				
Iron	mg/L	1.96E+01	4.70E+00	1.00E+00	2.20E+00				YES	7.09E-01	J				5.45E-01	J			
Magnesium	mg/L	1.10E+01	NA	8.20E+01	2.30E+00					1.45E+00					7.68E-01	J			
Manganese	mg/L	5.65E-01	6.40E-01	8.00E-02	2.34E-02	J				1.28E-02	J				1.27E-01				YES
Potassium	mg/L	2.56E+00	NA	5.30E+01	8.07E-01	J				ND					ND				
Sodium	mg/L	3.44E+00	NA	6.80E+02	1.07E+00					9.54E-01	J				1.06E+00				
Thallium	mg/L	2.49E-03	1.02E-03	4.00E-03	ND					9.18E-03	B	YES	YES	YES	4.00E-03	B	YES	YES	YES
VOLATILE ORGANIC COMPOUNDS																			
Acetone	mg/L	NA	1.57E+00	7.80E+01	2.30E-02	J				ND					2.50E-02	J			
Methylene chloride	mg/L	NA	1.42E-01	1.93E+00	ND					2.30E-04	B				ND				
EXPLOSIVES																			
RDX	mg/L	NA	1.10E-02	1.90E-01	2.80E-03					1.20E-03					ND				

[a] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] Recreational site user site-specific screening level (SSSL) and ecological screening value (ESV) as given in IT Corporation (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama,* July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit.

J - Compound was positively identified; reported value is an estimated concentration.

mg/L - Milligrams per liter.

NA - Not available.

ND - Not detected.

Qual - Data validation qualifier.

Table 5-5

Sediment Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location					RNG-109-SW/SD01					RNG-109-SW/SD02					RNG-109-SW/SD03				
Sample Number					NH1001					NH1003					NH1004				
Sample Date					21-Feb-02					21-Feb-02					21-Feb-02				
Sample Depth (Feet)					0- 0.5					0- 0.5					0- 0.5				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	8.59E+03	1.15E+06	NA	3.90E+03	J				6.80E+03	J				7.87E+03	J			
Arsenic	mg/kg	1.13E+01	5.58E+01	7.24E+00	7.51E+00	J			YES	6.60E+00	J				1.04E+01	J			YES
Barium	mg/kg	9.89E+01	8.36E+04	NA	9.20E+00	J				2.57E+01	J				2.21E+01	J			
Beryllium	mg/kg	9.70E-01	1.50E+02	NA	ND					ND					ND				
Calcium	mg/kg	1.11E+03	NA	NA	7.06E+01	J				1.15E+02	J				1.13E+02	J			
Chromium	mg/kg	3.12E+01	2.79E+03	5.23E+01	6.61E+00	J				8.93E+00					1.58E+01				
Cobalt	mg/kg	1.10E+01	6.72E+04	5.00E+01	1.61E+00	J				7.26E+00					8.07E+00				
Copper	mg/kg	1.71E+01	4.74E+04	1.87E+01	1.08E+01					1.03E+01					9.83E+00				
Iron	mg/kg	3.53E+04	3.59E+05	NA	8.06E+03	J				9.01E+03	J				1.47E+04	J			
Lead	mg/kg	3.78E+01	4.00E+02	3.02E+01	4.20E+00	J				1.07E+01	J				1.02E+01	J			
Magnesium	mg/kg	9.06E+02	NA	NA	1.94E+02	J				3.15E+02					3.55E+02				
Manganese	mg/kg	7.12E+02	4.38E+04	NA	8.31E+01	J				4.38E+02	J				4.20E+02	J			
Mercury	mg/kg	1.10E-01	2.99E+02	1.30E-01	ND					ND					ND				
Nickel	mg/kg	1.30E+01	1.76E+04	1.59E+01	2.09E+00	J				4.44E+00					5.86E+00				
Potassium	mg/kg	1.01E+03	NA	NA	2.02E+02	J				2.32E+02	J				2.85E+02	J			
Selenium	mg/kg	7.20E-01	5.96E+03	NA	ND					6.67E-01	J				ND				
Sodium	mg/kg	6.92E+02	NA	NA	3.72E+01	J				4.66E+01	J				5.00E+01	J			
Vanadium	mg/kg	4.09E+01	4.83E+03	NA	1.28E+01	J				1.52E+01					2.30E+01				
Zinc	mg/kg	5.27E+01	3.44E+05	1.24E+02	1.10E+01	J				2.07E+01	J				2.36E+01	J			
VOLATILE ORGANIC COMPOUNDS																			
1,2,4-Trimethylbenzene	mg/kg	NA	5.10E+04	NA	ND					ND					ND				
2-Butanone	mg/kg	NA	6.23E+05	1.37E-01	ND					1.70E-02	J				3.30E-02				
Acetone	mg/kg	NA	1.03E+05	4.53E-01	2.50E-02	B				9.90E-02	B				1.70E-01				
Carbon disulfide	mg/kg	NA	1.04E+05	1.34E-01	ND					ND					ND				
Methylene chloride	mg/kg	NA	9.84E+03	1.26E+00	2.00E-03	B				2.20E-03	B				2.00E-03	B			
Toluene	mg/kg	NA	2.11E+05	6.70E-01	ND					1.30E-03	J				1.80E-03	J			
m,p-Xylenes	mg/kg	NA	2.11E+06	2.50E-02	ND					ND					1.70E-03	J			
TOTAL ORGANIC CARBON																			
Total Organic Carbon	mg/kg	NA	NA	NA	5.31E+01					7.89E+01					7.84E+01				

Table 5-5

Sediment Analytical Results
Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location					RNG-109-SW/SD04					RNG-109-SW/SD05					RNG-109-SW/SD06				
Sample Number					NH1005					NH1006					NH1007				
Sample Date					22-Feb-02					20-Feb-02					20-Feb-02				
Sample Depth (Feet)					0- 0.5					0- 0.5					0- 0.5				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	8.59E+03	1.15E+06	NA	1.03E+04	J	YES			1.35E+04	J	YES			1.13E+04	J	YES		
Arsenic	mg/kg	1.13E+01	5.58E+01	7.24E+00	7.96E+00	J			YES	9.65E+00	J			YES	5.56E+00	J			
Barium	mg/kg	9.89E+01	8.36E+04	NA	7.84E+01	J				5.16E+01	J				5.52E+01	J			
Beryllium	mg/kg	9.70E-01	1.50E+02	NA	6.74E-01	J				ND					ND				
Calcium	mg/kg	1.11E+03	NA	NA	1.36E+03		YES			4.34E+02					2.16E+02				
Chromium	mg/kg	3.12E+01	2.79E+03	5.23E+01	8.16E+00					1.05E+01					9.96E+00				
Cobalt	mg/kg	1.10E+01	6.72E+04	5.00E+01	7.13E+00					5.00E+00					3.03E+00	J			
Copper	mg/kg	1.71E+01	4.74E+04	1.87E+01	7.99E+00					1.69E+01					1.20E+01				
Iron	mg/kg	3.53E+04	3.59E+05	NA	1.02E+04	J				1.35E+04	J				8.61E+03	J			
Lead	mg/kg	3.78E+01	4.00E+02	3.02E+01	1.81E+01	J				1.30E+01	J				1.37E+01	J			
Magnesium	mg/kg	9.06E+02	NA	NA	7.38E+02					6.76E+02					5.26E+02				
Manganese	mg/kg	7.12E+02	4.38E+04	NA	1.13E+03	J	YES			4.19E+02	J				7.20E+01	J			
Mercury	mg/kg	1.10E-01	2.99E+02	1.30E-01	4.27E-02	J				ND					ND				
Nickel	mg/kg	1.30E+01	1.76E+04	1.59E+01	8.44E+00					8.49E+00					7.61E+00				
Potassium	mg/kg	1.01E+03	NA	NA	2.38E+02	J				4.50E+02	J				4.79E+02	J			
Selenium	mg/kg	7.20E-01	5.96E+03	NA	ND					7.58E-01	J	YES			8.97E-01	J	YES		
Sodium	mg/kg	6.92E+02	NA	NA	4.39E+01	J				4.89E+01	J				5.35E+01	J			
Vanadium	mg/kg	4.09E+01	4.83E+03	NA	1.98E+01					2.50E+01					2.12E+01				
Zinc	mg/kg	5.27E+01	3.44E+05	1.24E+02	3.44E+01	J				3.90E+01	J				3.67E+01	J			
VOLATILE ORGANIC COMPOUNDS																			
1,2,4-Trimethylbenzene	mg/kg	NA	5.10E+04	NA	ND					1.80E-03	J				ND				
2-Butanone	mg/kg	NA	6.23E+05	1.37E-01	1.90E-02	J				1.50E-02	J				ND				
Acetone	mg/kg	NA	1.03E+05	4.53E-01	1.70E-01					1.20E-01	B				ND				
Carbon disulfide	mg/kg	NA	1.04E+05	1.34E-01	2.80E-03	J				ND					ND				
Methylene chloride	mg/kg	NA	9.84E+03	1.26E+00	2.00E-03	B				ND					ND				
Toluene	mg/kg	NA	2.11E+05	6.70E-01	2.80E-03	J				2.90E-03	J				4.60E-03	J			
m,p-Xylenes	mg/kg	NA	2.11E+06	2.50E-02	ND					2.40E-03	J				ND				
TOTAL ORGANIC CARBON																			
Total Organic Carbon	mg/kg	NA	NA	NA	7.76E+01					1.05E+02					1.27E+02				

[a] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] Recreational site user site-specific screening level (SSSL) and ecological screening value (ESV) as given in IT Corporation (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama,* July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit.

J - Compound was positively identified; reported value is an estimated concentration.

mg/kg - Milligrams per kilogram.

NA - Not available.

ND - Not detected.

Qual - Data validation qualifier.

5.1 Surface Soil Analytical Results

Eleven surface soil samples were collected for chemical analysis at Range 23A. Surface soil samples were collected from the uppermost foot of soil at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs, and metals background screening values as presented in Table 5-1.

Metals. Twenty metals were detected in surface soil samples collected at the site. Four metals (aluminum, arsenic, iron, and manganese) were detected at concentrations exceeding SSSLs. Of these metals, only arsenic (at sample locations RNG-109-GP01, RNG-109-GP03, RNG-109-MW02, and RNG-109-MW04) also exceeded its respective background concentration (13.73 mg/kg). Three of the arsenic results were flagged with a "J" data qualifier, signifying that the concentrations were estimated.

The concentrations of eight metals (aluminum, arsenic, chromium, iron, manganese, selenium, vanadium, and zinc) exceeded ESVs. Of these metals, arsenic (at sample locations RNG-109-GP01, RNG-109-GP03, RNG-109-MW02, and RNG-109-MW04), selenium (RNG-109-GP01 and RNG-109-MW04), and zinc (RNG-109-GP01) concentrations also exceeded their respective background values.

Volatile Organic Compounds. A total of six VOCs (1,2,4-trimethylbenzene, 1,2-dimethylbenzene, 2-butanone, acetone, xylenes, and toluene) were detected in the surface soil samples. All but two of the VOC results were flagged with either a "J" or "B" data qualifier, signifying that the reported concentration was estimated or that the compound was detected in an associated laboratory or field blank sample. The detected VOC concentrations were below SSSLs and ESVs.

Semivolatile Organic Compounds. SVOCs were not detected in the surface soil samples.

Explosives. Explosives were not detected in the surface soil samples.

5.2 Subsurface Soil Analytical Results

Eleven subsurface soil samples were collected for chemical analysis at Range 23A. Subsurface soil samples were collected at depths greater than 1 foot bgs at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background screening values, as presented in Table 5-2.

Metals. A total of 22 metals were detected in the subsurface soil samples. The concentrations of eight metals (aluminum, arsenic, barium, chromium, iron, manganese, thallium, and vanadium) exceeded SSSLs. Of these metals, aluminum (at three locations), arsenic (four locations), barium (RNG-109-GP06), manganese (RNG-109-GP02 and RNG-109-GP06), and thallium (RNG-109-GP06) also exceeded their respective background concentrations.

Volatile Organic Compounds. A total of 15 VOCs were detected in the subsurface soil samples. VOCs were not detected at one location (RNG-109-GP01) and acetone, a common laboratory contaminant, was the only detected VOC at five additional locations. Eleven of the 15 detected VOCs were present in the sample collected at RNG-109-GP04. The VOC concentrations in subsurface soil were all below SSSLs.

Semivolatile Organic Compounds. Four SVOCs (2-methylnaphthalene, fluorene, naphthalene, and phenanthrene) were detected in one of the subsurface soil samples (location RNG-109-GP04) collected at the site. SVOCs were not detected in remaining subsurface soil samples. The results were flagged with a "J" data qualifier, signifying that the concentrations were estimated. The SVOC concentrations in subsurface soil were all below SSSLs.

Explosives. Explosives were not detected in the subsurface soil samples.

5.3 Groundwater Analytical Results

Four permanent monitoring wells were sampled at Range 23A at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background concentrations, as presented in Table 5-3.

Metals. A total of 19 metals were detected in the groundwater samples collected at the site. Eleven metals were detected at concentrations exceeding SSSLs (10 detected in RNG-109-MW04). Of these results, concentrations of manganese (at RNG-109-MW02), thallium (RNG-109-MW03), and seven metals (aluminum, barium, beryllium, iron, lead, manganese, and vandium) at RNG-109-MW04 also exceeded their respective background concentrations (Note: background values were not available for chromium and nickel, which exceeded their respective SSSLs in RNG-109-MW04). With the exception of one manganese result and one "B"-flagged thallium result, the elevated metals concentrations were in the sample collected from monitoring well RNG-109-MW04. The metals detected above SSSLs and background in RNG-109-MW04 (aluminum, barium, beryllium, iron, lead, manganese, and vanadium) were either not detected in the remaining wells or their concentrations were below SSSLs and background, except for manganese in one well (RNG-109-MW02). It should be noted that the sample collected from

RNG-109-MW04 had high turbidity (greater than 1,000 NTUs) at the time of sample collection despite the implementation of low-flow purging. High turbidity has been previously shown to cause elevated metals concentrations in groundwater samples at FTMC (IT, 2000c) (Appendix H) and is believed to have caused the elevated metals results at this site.

Volatile Organic Compounds. Two VOCs (acetone and methylene chloride) were detected in one of the groundwater samples (location RNG-109-MW02) collected at the site. VOCs were not detected in the remaining groundwater samples. The acetone result (0.72 mg/L) exceeded its SSSL (0.16 mg/L) in the sample collected from RNG-109-MW02; however, the result was flagged with a "J" data qualifier, signifying that the concentration was estimated.

Semivolatile Organic Compounds. SVOCs were not detected in the groundwater samples.

Explosives. Explosives were not detected in the groundwater samples.

5.4 Surface Water Analytical Results

Six surface water samples were collected for chemical analysis at Range 23A at the locations shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-4. It should be noted that the assumptions for residential and recreational site user exposure to surface water are identical.

Metals. A total of 11 metals were detected in the surface water samples. Arsenic (at RNG-109-SW/SD04) and thallium (three locations) were detected at concentrations exceeding their respective SSSLs and background concentrations. All of the thallium results, however, were flagged with a "B" data qualifier indicating that thallium was also detected in an associated laboratory or field blank sample.

Six metals (aluminum, barium, cobalt, iron, manganese, and thallium) were detected at concentrations exceeding ESVs. Of these metals, only thallium in two samples also exceeded its respective background concentration (Note: a background value for cobalt was not available). All of the thallium results were flagged with a "B" data qualifier, indicating that thallium was also detected in an associated laboratory or field blank sample.

Volatile Organic Compounds. A total of two VOCs (acetone and methylene chloride) were detected in the surface water samples. The acetone results were flagged with a "J" data qualifier, signifying that the concentrations were estimated. The methylene chloride results were flagged

with a "B" data qualifier, signifying that the compound was also detected in an associated laboratory or field blank sample. The VOC results were below SSSLs and ESVs.

Semivolatile Organic Compounds. SVOCs were not detected in the surface water samples.

Explosives. One explosive compound (RDX) was detected in five of the six surface water samples. RDX was detected in all surface water samples except RNG-109-SW/SD06. All of the RDX results were below its SSSL and ESV.

5.5 Sediment Analytical Results

Six sediment samples were collected for chemical and physical analyses at Range 23A. Sediment samples were collected from the upper 6 inches of sediment at the locations shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-5. It should be noted that the assumptions for residential and recreational site user exposure to sediment are identical.

Metals. A total of 19 metals were detected in the sediment samples. The metals concentrations were all below SSSLs; however, arsenic exceeded its ESV at four locations. The arsenic results, all of which were flagged with a "J" data qualifier signifying that the concentrations were estimated, were below its background concentration.

Volatile Organic Compounds. A total of seven VOCs (acetone, methylene chloride, 2-butanone, toluene, m,p-xylenes, carbon disulfide, and 1,2,4-trimethylbenzene) were detected in the sediment samples. All but three of the VOC results were flagged with either a "J" or "B" data qualifier, signifying that the concentrations were estimated or that the compounds were also detected in an associated laboratory or field blank sample. The VOC results were below SSSLs and ESVs.

Semivolatile Organic Compounds. SVOCs were not detected in the sediment samples.

Explosives. Explosives were not detected in the sediment samples.

Total Organic Carbon. The sediment samples were analyzed for TOC. The TOC concentrations ranged from 53.1 mg/kg to 127 mg/kg, as summarized in Appendix E.

Grain Size. The results of the grain size analysis are included in Appendix E.

5.6 Statistical and Geochemical Evaluations of Site Metals Data

Site metals data were further evaluated using statistical and geochemical methods to determine if the metals detected in site media are site related. This multi-tiered approach is described in the Shaw technical memorandum "Selecting Site-Related Chemicals for Human Health and Ecological Risk Assessments for FTMC: Revision 2" (Shaw, 2003). The statistical and geochemical evaluations determined that the metals detected in site media were all naturally occurring (Appendix G).

5.7 Preliminary Ecological Risk Assessment

A PERA was performed to further characterize the potential threat to ecological receptors from exposure to environmental media at Range 23A. The PERA approach was derived from the screening-level ecological risk assessment (SLERA) protocol developed for FTMC and documented in the Installation-Wide Work Plan (IT, 1998). The PERA for Range 23A is included as Appendix I. It discusses the ecological habitat, environmental media of interest and data selection, selection of constituents of potential ecological concern (COPEC), risk characterization, uncertainty evaluation, and conclusions.

The media of interest at Range 23A are surface soil, groundwater, surface water, and sediment. Exposures to subsurface soil are unlikely for ecological receptors at this site. In order to determine whether constituents detected in site samples have the potential to pose adverse ecological risks, screening-level hazard quotients were developed in a three-step process as follows:

- Comparison to ESVs
- Identification of essential macronutrients
- Comparison to naturally occurring background concentrations.

The ESVs represent the most conservative values available from various literature sources and have been selected to be protective of the most sensitive ecological assessment endpoints. The ESVs have been developed specifically for FTMC in conjunction with EPA Region 4 and are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000b). The ESVs are based on no-observed-adverse-effect levels (NOAEL), when available. If a NOAEL-based ESV was not available for a certain constituent, then the most health-protective value available from the scientific literature was used. If a constituent was detected at a maximum concentration that exceeded its ESV, was not an essential macronutrient, and was greater than the naturally occurring levels at FTMC, then it was selected as a COPEC for further ecological risk characterization.

None of the constituents detected in site media were identified as COPECs. Therefore, the PERA concluded that potential risks to ecological receptors are insignificant.

6.0 Summary, Conclusions, and Recommendations

Shaw completed an SI at Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X, at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site as a result of mission-related Army activities. The SI consisted of the collection and analysis of 11 surface soil samples, 11 subsurface soil samples, 4 groundwater samples, 6 surface water samples, and 6 sediment samples. In addition, 4 permanent monitoring wells were installed in the saturated zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at the site indicates metals, VOCs, SVOCs, and one explosive compound were detected in the environmental media sampled. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to SSSLs, ESVs, and background screening values for FTMC. Site metals data were further evaluated using statistical and geochemical methods to select site-related metals. A PERA was also performed to characterize the potential risks to ecological receptors.

Although the site is located on Pelham Range and is projected for continued military training, the analytical data were evaluated against residential human health SSSLs to determine if the site is suitable for unrestricted future use. Various metals (aluminum, arsenic, barium manganese, and thallium) were detected in site media at concentrations exceeding SSSLs and background and, thus, were selected as chemicals of potential concern. However, the statistical and geochemical evaluation determined that the metals detected in site media were all naturally occurring. Acetone was also identified as a chemical of potential concern in groundwater. Although acetone was detected at an estimated concentration (0.72 mg/L) exceeding its SSSL (0.16 mg/L) in one groundwater sample, the compound is a common laboratory contaminant and is not believed to be site-related.

The PERA did not identify any COPECs in site media. Therefore, potential risks to ecological receptors were determined to be insignificant.

Based on the results of the SI, past operations at Range 23A do not appear to have adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, Shaw recommends

"No Further Action" and unrestricted land reuse with regard to CERCLA-related hazardous substances at Range 23A, Multipurpose Range, Parcel 109(7)/152Q-X.

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ATTACHMENT 1

LIST OF ABBREVIATIONS AND ACRONYMS